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August 31, 1958

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INDEX

Each i
Semian
clude
listing
number
No. 24

AVAILA

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NUCLEAR SCIENCE ABSTRACTS

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Nuclear Science Abstracts (NSA) is intended to serve scientists and engineers working in the field of atomic energy by abstracting as completely and as promptly as possible the literature of nuclear science and engineering. It covers not only unclassified and declassified research reports of the U. S. Atomic Energy Commission and its contractors, but also material that appears in research reports of other U. S. and foreign government agencies, universities, and industrial research organizations and in the technical and scientific journals.

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The Nuclear Data Sheets are available in a light-weight stock for insertion in binders and a heavy-weight stock for drawer filing. Annual subscription prices are $15 for the light and $18 for the heavy stock. Parcel post will be used in the U.S.A., printed matter mail elsewhere. Order from the Publications Office, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, Washington 25, D. C.

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The printing of this publication has been approved by the Director of the Bureau of the Budget, July 30, 1957.

CONTENTS

Volume 12, Number 16, August 31, 1958

Category	Abstract	Page
GENERAL	10282	1207
Atomic Bombs and Warfare	10286	1207
Atomic Power	10289	1208
Research Programs	10292	1208
BIOLOGY AND MEDICINE	10293	1208
Radiation Effects	10294	1208
Radiation Hazards and Protection	10320	1211
Radiography	10337	1214
Radiotherapy	10338	1214
Toxicology Studies	10342	1214
Tracer Applications	10346	1215
CHEMISTRY	10355	1216
Aerosols	10385	1220
Analytical Procedures	10386	1220
Atomic Weights and Periodic Systems	10419	1223
Crystallography and Crystal Structure	10421	1223
Deuterium and Deuterium Compounds	10423	1224
Fluorine and Fluorine Compounds	10427	1224
Graphite	10433	1225
Laboratories and Equipment	10438	1226
Molecular Structure	10447	1227
Radiation Chemistry	10448	1227
Radiation Effects	10460	1229
Rare Earths and Rare-earth Compounds	10464	1229
Separation Procedures	10469	1230
Sorption Phenomena	10488	1233
Spectroscopy	10493	1233
Syntheses	10496	1234
Tracer Applications	10497	1234
Transuranic Elements and Compounds	10498	1234
Uranium and Uranium Compounds	10505	1235
Waste Disposal	10522	1237
ENGINEERING	10528	1238
Heat Transfer and Fluid Flow	10532	1238
Materials Testing	10551	1241
Pumps	10555	1241
Radiography	10557	1242
Tracer Applications	10560	1242
Vacuum Systems	10561	1242
Waste Disposal	10564	1243
MINERALOGY, METALLURGY, AND CERAMICS	10566	1243
Ceramics and Refractories	10566	1243
Corrosion	10576	1244
Geology and Mineralogy	10595	1247
Metals and Metallurgy	10601	1248
PHYSICS	10675	1257
Aerosols	10709	1261
Astrophysics	10710	1261
Cosmic Radiation	10711	1261
Crystallography and Crystal Structure	10721	1262
Electrical Discharge	10727	1263
Electrons		
Gases	10741	1265
Instruments	10744	1265
Isotopes	10778	1269
Isotope Separation	10780	1269
Mass Spectrography	10784	1269
Mathematics	10791	1271
Measuring Instruments and Techniques	10800	1271
Mesons	10868	1281
Meteorology	10889	1283
Microwaves	10891	1283
Molecular Properties	10892	1283
Neutrons	10893	1284
Nuclear Physics	10905	1285
Nuclear Properties	10936	1289
Nuclear Reactors	10966	1293
Nuclear Transformation	11043	1303
Particle Accelerators	11052	1304
Radiation Absorption and Scattering	11115	1312
Radiation Effects	11145	1315
Radioactivity	11153	1316
Rare Earths and Rare-earth Compounds	11157	1316
Shielding	11162	1317
Spectroscopy	11163	1318
Theoretical Physics	11170	1319
Uranium and Uranium Compounds	11186	1320
PATENTS	11198	1322
Engineering	11198	1322
Physics	11200	1322
NUMERICAL INDEX OF REPORTS		INDEX-1
PERSONAL AUTHOR INDEX		INDEX-3

NUCLEAR SCIENCE ABSTRACTS

Volume 12 Number 16 August 31, 1958

GENERAL

10282 TID-4550(5th Rev.)
Technical Information Service Extension, AEC.
WHAT'S AVAILABLE IN THE UNCLASSIFIED ATOMIC ENERGY LITERATURE. July 1958. 67p.

Sources of available unclassified literature in the field of atomic energy are listed. Information is included on how to locate and obtain this information. Assistance is given in using fully the information announced in abstract journals, indexes, bibliographies, and other information guides issued by the U. S. Atomic Energy Commission. The report codes used by the Atomic Energy Commission and its contractors are explained, and their uses in bibliographic control of information are discussed. The major sources of information developed in the national nuclear energy program are listed. Complete instructions are given on how to obtain unclassified materials through the Atomic Energy Commission depository libraries and the Office of Technical Services. A list of pamphlets covering questions concerning licenses, contracts, government regulations, and other administrative matters pertinent to the Civilian Application Program is given. (C.H.)

10283
THE USE OF RADIOACTIVE ISOTOPES IN THE USSR. G. V. Kurdyumov, M. B. Neyman, and G. M. Frank. Atomnaya Energiya 3, 465-78(1957). (In Russian)

Some of the most important uses of radioisotopes in chemistry, biology, medicine, and agriculture in the Soviet Union are described. (J.S.R.)

10284
PROSPECTIVE ATOMIC AIRCRAFT. Kryl'ya Rodiny 8, 25(1957). (In Russian)

A brief review is given of prospective aircraft using atomic power. The types of aircraft mentioned are the atomic electrically driven aircraft, the nuclear turbojet, the ion-flux rocket, and the thermonuclear rocket missile. (J.S.R.)

10285
INDUSTRIAL USES OF RADIOISOTOPES. Studies in Business Policy, No. 87. New York, National Industrial Conference Board, Inc., 1958. 88p. $5.00.

Present industrial applications of radioisotopes are reviewed and possible future uses are discussed. Principal applications discussed include radioisotope gages for thickness gaging, density measurements, and indicating liquid levels; as sources for industrial radiography and inspection; tracer applications in wear and corrosion studies, flow and location determinations, chemical reactions studies, and chemical analysis; as ionization sources; in atomic batteries; as radiation sources for use in the sterilization of foods, drugs, and pharmaceuticals; in plant breeding; for the induction of chemical reactions; and as high intensity sources of radiation. The United States, Canadian, and United Kingdom radioisotope programs are discussed. (C.H.)

Atomic Bombs and Warfare

10286 DRCL-262
Canada. Defence Research Chemical Labs., Ottawa.
A SIMPLE POSITION OF BURST AND YIELD INDICATOR. J. R. Cunningham, J. A. Carruthers, and W. V. Wilkinson. Feb. 1958. 20p. Project D-89-16-80-15.

A simple device has been designed and constructed for determining the direction and yield of a nuclear explosion. The device consists of a block of expanded polystyrene foam inside a metal container. Apertures in the container limit the incident thermal energy with the result that a hole is melted into the polyfoam. The depth of the hole and its position relative to the aperture enable the thermal energy flux and the direction to the point of burst to be obtained. Information from more than one such device may be used to obtain the yield and position of burst. The device is simple to manufacture, requires no maintenance and is not affected by sun or by weathering. Maximum sensitivity is about 0.5 $cal/cm^2/sec$. A field test indicated satisfactory behavior and an energy accuracy of about 30%. (auth)

10287 NAVDOCKS-P-290
Bureau of Yards and Docks.
STUDIES IN ATOMIC DEFENSE ENGINEERING. Jan. 1957. 91p.

The information compiled forms an introduction to those phases of atomic defense engineering which are of particular interest to engineers concerned with planning, building, and maintaining the shore facilities of the Navy. (W.D.M.)

10288
THE RADIOACTIVE HAZARDS FROM THE EXPLOSION OF A HYDROGEN BOMB AND AN ORDINARY ATOMIC BOMB. O. I. Leypunskiy. Atomnaya Energiya 3, 530-9(1957).

The hazards for the total world population caused by the long-lived fission products from the explosion of an atomic or hydrogen bomb are estimated. The dose of irradiation on the body are computed, and the number of cases of radiation injury (especially leukemia) developing afterwards is estimated. For a hydrogen bomb C^{14} and H^3 are the dangerous isotopes, and for an atomic bomb Sr^{90}, Cs^{137}, and C^{14}. The total decay energy of the fission products from a hydrogen bomb is about three

times higher than that from an atomic bomb. However, the irradiation doses and the fatalities during the decay of the radioactive isotopes are equally high for both bombs. It cannot be said that the hydrogen bomb is less dangerous than the atomic bomb from the viewpoint of radiation injuries. (J.S.R.)

Atomic Power

Refer also to abstract 11203.

10289 AECL-561
Atomic Energy of Canada Ltd., Chalk River, Ont.
A STATEMENT OF THE NUCLEAR POWER DEVELOPMENT PROGRAM. J. L. Gray. Feb. 1958. 26p.

The status of power reactor developments in Canada in 1958 is reviewed. The need for nuclear power is discussed, and the program for the immediate future is outlined. Appended is an outline of objectives for the full scale nuclear power plant project and plant specifications, and a time schedule for the Canadian Deuterium Uranium Reactor (CANDU). Organization charts for the Nuclear Power Plant Division are included. (C.H.)

10290
ATOMIC ENGINES FOR SHIPS. V. V. Lakhanin. Atomnaya Energiya 3, 222-6(1957).

In various countries, such as the U.S.A., Norway, and Japan, it is intended to build ships driven by atomic power. From what has been hitherto published it may be said that atomic ships' engines must develop at least 10,000 HP, the speed of these vessels must be 18 to 21 knots, and as a driving unit a steam or gas turbine must be used. At present the system of a boiling water reactor, 2 heat transfer circuits, and steam turbine seems to be the easiest possible construction. If the three points mentioned above are fulfilled, it may be said that, from an economic point of view, ships with atomic drive are already well able to compete with ordinary vessels. Conditions may even improve in the factor of vessels with atomic drive if it is possible to construct reactors with high working temperatures in order that gas turbines may be used as a driving aggregate. (TCO).

10291
THE DEVELOPMENT OF ATOMIC ENERGY IN THE USSR. N. A. Nikolayev. Atomnaya Energiya 3, 385-90 (1957). (In Russian)

The types of reactors being used in the new atomic power stations are described. A brief discussion is given of the types of reactors which are to be built in the next five-year plan. (J.S.R.)

Research Programs

10292 NP-6769
American Consulate General, Frankfurt am Main. Science Div.
GERMAN SCIENCE BULLETIN NUMBER 26. May 1958. 59p.

Summaries of the papers presented at the meeting of the Nuclear Physicists Committee of the Northwestern Germany Physical Society, at Bonn and Bad Neuenahr are presented. Brief reports are given of work on: high-gain microwave antennas, new high-current low-inductivity condenser for nuclear fusion experiments, fine division of a pulse generator disk in an electronic computer, and Heisenberg's formula and dialectical materialism. (T.R.H.)

BIOLOGY AND MEDICINE

10293 AERE-Med/R-2512
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
ERRORS AND VARIATIONS IN WHITE CELL COUNTS. [PART] II. DIURNAL AND OTHER PHYSIOLOGICAL VARIATIONS. A. C. Chamberlain and F. M. Turner. Jan. 1958. 16p.

An investigation was made of the variation in the leukocyte count of normal persons during a day. Seven subjects were used, and duplicate counts were made at seven times daily at intervals during a period extending over several weeks. A statistical analysis of results shows diurnal and other physiological variations. (C.H.)

Radiation Effects

10294 AF-SAM-58-58
Texas. Univ., Austin. Radiobiological Lab.
SOME EFFECTS OF NUCLEAR RADIATION EXPOSURE ON THE BEHAVIOR OF THE RHESUS MONKEY. A. A. McDowell and W. Lynn Brown. Dec. 4, 1957. 5p.

The behavior of rhesus monkeys was studied after they had been exposed to nuclear radiation. Deficits were shown in nondirected locomotor activity and in object-directed activity; an increment was shown in self-directed activity. This behavioral syndrome is comparable to that produced in monkeys by laboratory exposure to radiation. (auth)

10295 AMRL-337
Army Medical Research Lab., Fort Knox, Ky.
RELATIVE BIOLOGICAL EFFECTIVENESS OF COBALT 60 GAMMA RADIATION FOR VARIOUS RESPONSES IN MICE. J. G. Kereiakes and M. S. Miraglia. Apr. 26, 1958. 21p. Project No. 6-59-08-014.

The biological effectiveness of cobalt 60 gamma irradiation relative to 250 kvp x irradiation for six different responses in mice were found to be: 30-day lethality, 0.76; median survival time, 0.78; body weight loss, 0.76; intestinal atrophy, 1.00; splenic atrophy, 1.00; testicular atrophy, 0.60. Possible reasons for the differences are discussed. (auth)

10296 NP-6763
School of Aviation Medicine, Randolph AFB, Tex.
AIRCRAFT NUCLEAR PROPULSION BIOMEDICAL RESEARCH PROGRAM. REPORT NO. 4. RADIOBIOLOGIC PROBLEMS OF ANP. Robert M. Dowben, Daniel B. Williams, Edward M. Miller, and John E. Pickering. Oct. 1955. 11p.

The biological effects of exposure to low radiation dose rates over a long period of time are discussed. Problems in the quantitative determination of the differences in biological response to physically equivalent doses of various radiations are reviewed. Factors to be considered in establishing permissible radiation levels for the crews of nuclear aircraft are discussed. (C.H.)

10297 NP-6764
School of Aviation Medicine, Randolph AFB, Tex.
AIRCRAFT NUCLEAR PROPULSION BIOMEDICAL RESEARCH PROGRAM. REPORT NO. 5. CONTRACT RESEARCH ON RADIOBIOLOGIC PROBLEMS OF ANP. [1958]. 18p.

Long term research studies on the acute and chronic biological effects of mixed neutron and gamma radia-

tion on experimental animals are outlined. Emphasis is placed on studies aimed at defining permissible exposure levels for nuclear aircraft personnel. Other problems of interest include the biologic and physiologic effects, mechanisms, and kinetics of radiation injury; the development of prophylactic and therapeutic treatments for radiation injuries; and the development of standardized dosimetry for the expression of tolerance doses. (C.H.)

10298 UR-521

Rochester, N. Y. Univ. Atomic Energy Project. INTERACTIONS BETWEEN CELLS AND TISSUES FOLLOWING RADIATION. George W. Casarett. Feb. 14, 1958. 38p. Contract W-7401-eng-49. $6.30 (ph OTS); $3.00(mf OTS).

A general discussion is presented of many indirect biologic effects of ionizing radiation in the mammalian body. The mechanisms by which radiation effects in cell cells or tissues or organs affect the structures or systems which they compose or other cells, tissues, or organs are discussed. Not only accepted concepts but also controversial issues and ideas intended to provoke contention and stimulate discussion are presented. In general, some of the principal radiation problems discussed briefly are: types of relatively direct biologic effects on cells; effects in various tissues, organs, and physiologic systems; indirect effects on cells and tissues or systems due to more direct effects on neighboring cells and tissues, to circulating toxins, to functional responses of homeostatic or defense systems, and to various types of vascular change; mechanisms of amplification of early radiation effects to greater effects associated with morbidity and mortality; typical and atypical regeneration and repair; recovery of tissues from radiation effects; irreversible effects, including persistence of defective cells or cell products, reduction of regenerative capacity of tissues, and asynchronous or atypical repair of tissues; radiation tumorigenesis; and acceleration of aging. (auth)

10299 USNRDL-TR-239

Naval Radiobiological Defense Lab., San Francisco. THE EFFECT OF MULTIPLE DOSAGES AND PARTIAL-BODY X-IRRADIATION ON URINARY TAURINE EXCRETION BY THE RAT. R. E. Kay and C. Entenman. May 29, 1958. 25p.

The effect of multiple dosages, shielding and organectomies on the hourly and daily excretion of taurine following x irradiation was studied in the fasting rat. Data are tabulated and presented graphically. (auth)

10300 AEC-tr-3223

THE HISTOPATHOLOGY OF THE NERVOUS SYSTEM DURING VARIOUS STAGES OF INTENSE RADIATION ILLNESS. A. G. Beglaryan, K. A. Kyandaryan, and S. A. Papoyan. Translated from Doklady Akad. Nauk S.S.S.R. 112, 422-4(1957). 6p.

Histomorphological examination of tissue sections from rabbits exposed to lethal doses of x radiation revealed changes in all regions of the central nervous system. (C.H.)

10301

THE EFFECT OF DIFFERENT DOSES OF ROENTGEN RAYS ON ADULT AXOLOTL (SIREDON MEXICANUM). V. V. Brunst (Roswell Park Memorial Inst., Buffalo, N. Y.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 80, 126-42(1958) July.

Eighty adult axolotls were irradiated with doses of x radiation ranging from 500 to 12,000 r. Data are presented on the mean survival time for each dosage level and the effects of each dosage on the tissues and organs. (C.H.)

10302

BIOCHEMICAL EFFECTS OF GAMMA RADIATION ON POTATO TUBERS. Sigmund Schwimmer, William J. Weston, and R. U. Makower (Western Regional Research Lab., Albany, Calif.). Arch. Biochem. Biophys. 75, 425-34(1958) June.

A survey was made of biochemical changes which follow the irradiation of potato tubers. To account for apparent alteration in enzyme activity in the postirradiation stage, a theory is proposed in which new steady-state concentrations of the enzyme in the cell arise as a result of the differential radiosensitivity of the mechanisms for synthesis of an enzyme as compared with the mechanism for its degradation. (C.H.)

10303

S^{35}-METHIONINE UPTAKE BY PROTEINS OF THE STRUCTURAL ELEMENTS OF TISSUE CELLS IN IRRADIATED RATS. L. I. Ilyina. Bull. Exptl. Biol. Med. (USSR) (English Translation) 44, 1204-8(1957) Oct.

Methionine labeled with sulfur-35 was used in studies on disturbances in protein metabolism in liver and intestinal mucosa of rats following exposure to 800 r x radiation. A group of control animals was also examined for radioactive protein synthesis, and results are compared with those for irradiated animals. (C.H.)

10304

THE RADIATION DANGER. H. J. Muller. Colorado Quarterly 6, No. 3, 229-54(1958).

The biological effects of present-day practices involving radiation are discussed. The magnitude of radiation damage to posterity is considered. (C.H.)

10305

SUGAR ACCUMULATION IN WHEAT LEAVES UNDER THE INFLUENCE OF X-RAY TREATMENT. I. M. Vasil'ev, N. D. Rybalka, and Tsin Su-Yun (Inst. of Biological Physics, Academy of Sciences, USSR). Doklady Akad. Nauk. S.S.S.R. 119, 62-4(1958) Mar. 1. (In Russian)

Analysis showed an increase of sugar content in the leaves of plants irradiated with 1000, 3000, 5000, 50,000, and 100,000 r. The 3000- and 5000-r doses showed a considerably higher sugar accumulation effect than the lesser or higher doses. The accumulations of saccharose were higher than monosaccaride. Great concentrations of saccharose were especially observed with doses of 3000 and 5000 r. (R.V.J.)

10306

THE INFLUENCE OF β-PARTICLES OF RADIOACTIVE ISOTOPES ON SIZE VARIATION IN CHLOROPLASTS OF ELODEA CANADENSIS. P. A. Vlassyuk and N. I. Bidzilya (Ukrainian Research Inst. of Plant Physiology). Doklady Akad. Nauk S.S.S.R. 119, 65-7(1958) Mar. 1. (In Russian)

Effects of β particles from S^{35}, Ca^{45}, W^{185}, and P^{32} on the size changes of chloroplasts in Elodea canadensis cells were studied. There are indications that small doses of β particles increase the Elodea chloroplasts.

10307

EFFECTS OF ANTITUMOR COMPOUNDS AND RADIATION ON THE GLYCOLYSIS AND RESPIRATION OF ASCITES-TUMOR CELLS. Toshiaki Ebina and Moriji Kurosu (Tohoku Univ., Sendai, Japan). J. Natl. Cancer Inst. 20, 1023-36(1958) June.

Effects of 9 well-known antitumor compounds, 14 allyl compounds, and x irradiation on the respiration and glycolysis of ascites-tumor cells were investigated and compared with the growth-inhibitory effects on Ehrlich solid tumor. The present in vitro study indicated that all the antitumor agents used do not show the same ef-

fect on the glycolysis and respiration of ascites-tumor cells. Inhibition, stimulation, and no effect were observed in both glycolysis and respiration. Thus, there was no general correlation between the effect of a compound on tissue metabolism and its effect on tumor growth. (auth)

10308

IMMUNOLOGICAL CHARACTERISTICS OF RADIATION CHIMAERAS. P. L. T. Ilbery, P. C. Koller, and J. F. Loutit (Atomic Energy Research Establishment, Harwell, Berks, Eng. and Chester Beatty Research Inst., London). J. Natl. Cancer Inst. 20, 1051-89(1958) June.

Radiation chimaeras are mice that due to bone-marrow therapy survive LD100 total-body x irradiation. The donor material may differ genetically from the irradiated recipient. According to the genetic relationship between the host and donor, radiation mouse chimaeras can be grouped as isologous, semi-isologous, syngenetic, homologous, and heterologous. The immunological responses of the various chimaeras were analyzed by challenging them with different tumors. (auth)

10309

PATHOLOGICAL EFFECT OF BETA RAYS ON A PHYTOPATHOGENIC FUNGUS. E. Castellani, A. Matta, and C. Guerzoni (Universita degli Studi, Turin and Centro di Studi fisco-biologici del C.N.R.). Minerva nucleare 2, 56-9(1958) Mar. (In Italian)

Conidia of Gloeosporium musarum were exposed to beta rays from a 31-Mev betatron with doses from 16,500 to 830,000 r. Doses higher than 300,000 r almost completely inhibited germination. Lower doses caused, in the conidia and in their germinating forms, definite changes in the morphology and internal structure, with increasing frequency of change at doses higher than 50,000 r. These changes are illustrated and are considered evidence of a true radiation disease. (auth)

10310

THE EFFECT OF IONIZING RADIATION ON THE SYNTHESIS OF PORPHOBILINOGEN AND OF PORPHYRIN. G. F. Rubino, L. Rasetti, and G. A. Teso (Istituto di Clinica Medica dell'Universita, Turin). Minerva nucleare 2, 74-6(1958) Mar. (In Italian)

The synthesis of porphyrins and porphobilinogen (PBG) was studied in the liver and kidney and in the erythrocytes of rats following x irradiation. Following irradiation there is a slight but constant increase of the copro- and protoporphyrin in the liver, kidney, and erythrocytes. Particularly in the red blood cells the increase is 6 times normal after 24 hours and persists until the 7th day, when it drops sharply to 0. The synthesis of protoporphyrins increases after irradiation, the increase being almost 20 times normal in the erythrocytes after 24 hours and persisting until the 3rd or 4th day, though decreasing progressively. On the other hand the synthesis of coproporphyrins decreases in all the organs investigated and is practically inhibited on the 3rd day. The synthesis of porphobilinogen, i.e., the ala-dehydrase content, increases during the first 3 days in the liver and kidney and is practically unvaried in the erythrocytes. It seems probable that irradiation alters the enzyme systems concerned with the synthesis of the porphyrin compounds. (auth)

10311

AN APPARENT BENEFICIAL EFFECT OF GAMMA-RADIATION ON THE FLOUR MITE. Colin Melville (The Univ., Manchester, Eng.). Nature 181, 1403-4 (1958) May 17.

A single irradiation at 5×10^3 and also at 10^4 rad gamma radiation resulted in an increase in the number of eggs laid and hatched by the flour beetle, Tyroglyphus farinae. In contrast, irradiation at 2×10^4 rad significantly reduced the number of eggs laid and hatched, and a dose of 4×10^4 rad apparently sterilized the population. (C.H.)

10312

ELIMINATION OF HETEROLOGOUS PROTEINS FROM BLOOD OF NORMAL, X-RADIATED AND TOLERANT RABBITS. William O. Weigle and Frank J. Dixon (Univ. of Pittsburgh School of Medicine). Proc. Soc. Exptl. Biol. Med. 98, 213-15(1958) June.

Rates of elimination of heterologous serum proteins during the exponential phase are similar in normal, x-radiated, and immunologically tolerant rabbits and do not appear to be immunologically determined. (auth)

10313

FAILURE TO DEMONSTRATE TOXIC FACTORS IN THE SERUM OF IRRADIATED RATS. Robert D. Campo, Victor P. Bond, and Eugene P. Cronkite (St. John's Univ., Brooklyn N. Y. and Brookhaven National Lab., Upton, N. Y.). Proc. Soc. Exptl. Biol. Med. 98, 440-3(1958) June.

Three experimental procedures were utilized to assay serum from irradiated rats for radiotoxic substances. Such toxic material was not demonstrable by these technics. These experiments do not preclude the existence of radiotoxins in the irradiated animal, but they do indicate that if radiotoxins exist, the blood is probably not their principal storehouse. If, on the other hand, the blood does figure significantly in their storage, then they are not responsible for the severe signs and symptoms resulting from acute total-body exposure. (auth)

10314

THE EFFECT OF IONIZING RADIATION ON THE SYNTHESIS OF T1 PHAGE PROTEIN. Gordon Whitmore and Ernest Pollard (Yale Univ., New Haven, Conn.). Radiation Research 8, 392-410(1958) May.

The formation of specific antigen, defined as material of large molecular weight, which will combine with T1 antibody, by T1-infected E. coli at various stages of the latent period has been studied. X irradiation of the cells before infection reduces the formation of specific antigen with a two-component inactivation process, some cells being about three times as sensitive as others. X irradiation destroys the ability of free phage to combine with antiserum, but with a very low sensitivity. The ability to produce infectious centers is affected by x rays with a higher sensitivity than for antigen synthesis. The capacity to produce infectious centers is affected by x rays applied before infection, again with a two-component process. At later stages in the multiplication process there appears a less sensitive component which can be identified with mature phage. Irradiation with deuterons and α-particles of various LET follows the same pattern. The data are consistent with the existence of a single sensitive synthetic site which could be determined by a DNA chain of length 0.97 μ for protein synthesis and 2.5 μ for the formation of infectious centers. (auth)

10315

THE DEPRESSANT EFFECT OF CONTINUOUS COBALT-60 RADIATION ON THE SECONDARY TETANUS ANTITOXIN RESPONSE IN MICE. Richard D. Stoner and William M. Hale (Brookhaven National Lab., Upton, N. Y. and Univ. of Tennessee, Memphis). Radiation Research 8, 438-48(1958) May.

The radiosensitivity of the secondary tetanus antitoxin response in mice was demonstrated after rather low

doses of continuous γ-radiation given at a dose rate of 4 rep/hr. Accumulated doses of 48 to 288 rep depressed antitoxin formation. Comparable doses of acute γ-radiation did not depress antitoxin production. Acute doses of 350 to 650 rep sharply depressed the secondary antibody response, however. Extended periods of continuous γ-radiation from 10 to 28 days to accumulated doses of 960 to 2688 rep markedly depressed the secondary antibody response. An accumulated dose of 2688 rep was needed to depress antitoxin formation to the level observed after an acute dose of 650 rep. When the secondary stimulus of fluid tetanus toxoid was given prior to 10 days of continuous exposure to an accumulated dose of 960 rep, the secondary antibody response was not depressed. Irradiated mice recovered the ability to produce a normal secondary antitoxin response during the second week after an accumulated dose of 1248 rep. The secondary antitoxin response was depressed in mice given long-continued γ-radiation at a dose rate of 1 rep/hr. (auth)

10316

ENHANCING EFFECT OF CONTINUOUS COBALT-60 GAMMA-RADIATION ON SUSCEPTIBILITY TO ANAPHYLACTIC SHOCK IN MICE. William M. Hale and Richard D. Stoner (Univ. of Tennessee, Memphis and Brookhaven National Lab., Upton, N. Y.). Radiation Research 8, 449-59(1958) May.

Continuous exposure to γ-radiation at a dose rate of 4 rep/hr enhanced the severity of anaphylactic shock in mice sensitized with tetanus toxoid and challenged 1 hour or 7 days postradiation with fluid tetanus toxoid. A sharp increase in susceptibility to fatal anaphylaxis was observed as the accumulated dose was increased from 192 to 288 rep. Recovery from the enhancing effect of continuous γ-radiation began during the second week postradiation; complete recovery occurred during the third week after an accumulated dose of 672 rep. Anaphylactic shock was demonstrable in mice sensitized 6 months before challenge with the specific antigen. An enhanced susceptibility to fatal anaphylaxis was obtained when these animals were given an accumulated dose of 288 rep and challenged 1 hour postradiation. Passive anaphylaxis was more severe in irradiated mice sensitized with homologous antitoxin 1 hour postradiation and challenged the following day with tetanus toxoid. The antihistaminic agent Thephorin afforded complete protection from fatal anaphylaxis in irradiated mice. (auth)

10317

ACUTE RADIATION CHANGES IN THE PURKINJE CELLS. D. M. Perese, W. T. Murphy, and J. A. Parsons (Roswell Park Memorial Inst., Buffalo, N. Y.). Radiology 70, 855-9(1958) June.

Early changes were observed in the Purkinje cells from the brain of mice subjected to total doses of radiation varying from 267 to 5,340 r delivered in 16 to 32 days. The animals showed no recognizable alteration in behavior. Similar acute changes were observed in the Golgi network of the Purkinje cells of a patient following administration of 800 r x radiation within 23 days. (C.H.)

10318

CHRONIC RADIATION HAZARDS. AN EXPERIMENTAL STUDY WITH FAST NEUTRONS. G. J. Neary, R. J. Munson, and R. H. Mole. New York, Pergamon Press, 1957. 198p.

Mice were subjected to chronic radiation exposure from a nuclear reactor for several years. The doses of fast neutrons, gamma radiation, and thermal neutrons were measured by the use of three chambers with different sensitivities to the three kinds of radiation. Quite precise estimates of the separate effects of the three kinds of radiation were possible by making use of an approximate value for the energy of the fast neutrons, and from this information the true tissue doses in rads could be obtained. The effect of 0.54 rads weekly of fast neutrons on the life span of mice was small and is statistically uncertain. The higher dose of 6.4 rads weekly did not effect the white blood cell count but caused a marked drop in body weight and shortened life by one third. After 2 to 5 months at 6.4 rads weekly, fertility in both males and females was seriously impaired. The reproductive function was found to be the most sensitive indicator of chronic radiation damage. Irradiation techniques and facilities are described. The interpretation of the results of chronic toxicological experiments are discussed. (C.H.)

10319

MODIFICATION OF X-RAY MUTAGENESIS IN DROSOPHILA. RELATIVE SENSITIVITY OF SPERMATIDS AND MATURE SPERMATOZOA. I. I. Oster (Indiana Univ., Bloomington). pp. 475-80 in "Proceedings of the 5th International Conference on Radiobiology held in Stockholm Aug. 15-19, 1957", by George C. de Hevesy, A. G. Forssberg, and J. D. Abbatt. London, Oliver and Boyd, 1957. 503p.

A series of experiments showed that spermatids represent the most radiosensitive stage of gametogenesis in Drosophila. (C.H.)

Radiation Hazards and Protection

Refer also to abstract 10228.

10320 AMRL-332

Army Medical Research Lab., Fort Knox, Ky.

THE EFFECT OF SUBCUTANEOUSLY INJECTED COBALT ON THE ERYTHROPOIETIC ACTIVITY AND RADIOSENSITIVITY OF X-IRRADIATED MICE. W. H. Parr and R. A. Van Metre. Apr. 11, 1958. 20p. Project No. 6-59-08-014.

A single subcutaneous dose of 1.0 mg cobaltous chloride per 10 g body weight stimulated the erythropoietic activity of mice surviving the toxic effects. Single doses below this level gave little indication of increasing the red blood cell count while doses beyond this level were lethal to all mice. Daily subcutaneous injections of 0.8 mg cobaltous chloride per 10 g body weight increased red blood cell formation in mice that survived the toxic effects. With daily subcutaneous injections given in combination with a single lethal dose of x rays, cobalt's erythropoietic stimulating property was less obvious, but an increase in radiosensitivity was observed. Daily doses of less than 0.6 mg cobaltous chloride per 10 g body weight had little effect on the red cell count or on the radiosensitivity. (auth)

10321 KAPL-1832

Knolls Atomic Power Lab., Schenectady, N. Y.

RADIATION EXPOSURE AUDITING. M. R. Kennedy and G. W. Gasper. Dec. 15, 1957. 47p. Contract W-31-109-Eng-52. $1.50(OTS).

The methods in use at the Knolls Atomic Power Laboratory by the Health Physics group to complete a radiation exposure audit are discussed. This report includes discussions of personnel monitoring equipment, calibration procedure, methods of evaluating a possible exposure to external radiation, and the manner in which a potential exposure to air-borne radioactive materials is estimated and evaluated. (auth)

10322 KAPL-1887
Knolls Atomic Power Lab., Schenectady, N. Y.
RADIOLOGICAL DEVELOPMENT ACTIVITIES IN HEALTH PHYSICS. Semiannual Progress Report [for] July–December 1956. L. J. Cherubin and J. J. Fitzgerald. 54p. Contract W-31-109-Eng-52. $1.50 (OTS).

The efficiencies of respirator filter media (American Optical Type R-57 and MSA Type H Comfo Ultra Filter) were found relatively high under test conditions. Three reports on air sampling and collection efficiency studies were prepared for publication in technical journals. Several types of beta pocket dosimeters were constructed, tested, and evaluated. Correction factors for mixed radiation fields and beta energies were established. A fast-neutron pocket dosimeter was designed and constructed. Theoretical considerations concerning the selection of chamber gases are discussed with respect to the response to fast-neutron fluxes. Modifications in the foil badge neutron dosimeter system were introduced to facilitate the use and increase the effective sensitivity of the dosimeter. A method for calibrating and evaluating beta hand counters is discussed with reference to the use of single and multiple sources, and the use of uranium and mixed fission-product sources. Modifications in the methods of collecting fish and plankton were introduced to provide an improved and more representative sampling program. No significant accumulation of radioactive materials in plankton was detected during this period. Analyses of fish tissues indicate an apparent decrease in radioactive material concentrations in 14% of the specimens analyzed, an increase in 48% of the analyzed specimens, and no increase or decrease in 38% of the analyzed specimens. Criteria are set forth to aid in the rapid and essentially complete evaluation of critical assembly environmental hazards. The probability, consequences, and ranges of hazards associated with a nuclear incident are discussed. A brief description of exclusion area, containment, shielding, plant layout, emergency planning, and evacuation procedure considerations is presented to aid in the development of adequate radiation protection measures. (For preceding period see KAPL-1615.) (auth)

10323 KAPL-1914
Knolls Atomic Power Lab., Schenectady, N. Y.
HEALTH PHYSICS REPORT FOR OCTOBER, NOVEMBER, DECEMBER 1957. 43p. Contract W-31-109-Eng-52. $1.25(OTS).

Personnel, in-plant, and environmental radiation monitoring procedures engaged in during the period are summarized. (For preceding period see KAPL-1889.) (C.H.)

10324 RFP-92
Dow Chemical Co. Rocky Flats Plant, Denver.
DETECTION AND MEASUREMENT OF RADIOACTIVE PARTICULATES. T. S. Chapman. Dec. 5, 1957. 16p. Contract AT(29-1)-1106. $3.30(ph OTS); $2.40(mf OTS).

Factors contributing to the natural radioactivity of the atmosphere are reviewed. A number of devices are described and illustrated photographically which are used for sampling the air for airborne radioactive particulate matter. (C.H.)

10325 SCTM-80-57(51)
Sandia Corp., Albuquerque, N. Mex.
FALLOUT FROM A HYPOTHETICAL 1-MT SURFACE BURST AT ALBUQUERQUE. L. J. Vortman. Mar. 10, 1957. 7p. Contract [AT(29-1)-789]. (M-6196). $1.80 (ph OTS); $1.80(mf OTS).

The direction and extent of fall-out from a hypothetical 1-mt surface burst at Albuquerque are examined using available 1956 wind data. (auth)

10326 UCRL-8115
California. Univ., Berkeley. Radiation Lab.
RADIATION HAZARDS IN SPACE FLIGHT.
Cornelius A. Tobias. Jan. 1958. 32p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

The knowledge pertinent to dose evaluation is reviewed for conditions of flight in space in the vicinity of the earth but away from the influence of its atmosphere or magnetic field. Certain properties of the heavy nuclei are also discussed as well as some of the available information on their actual biological effects. The statistical nature of the hazard from cosmic radiations and the limitations of space flight due to such rays are discussed. (W.L.H.)

10327 USNRDL-TR-243
Naval Radiological Defense Lab., San Francisco.
MODIFICATION OF RADIATION INJURY IN RATS THROUGH GASTROINTESTINAL TRACT SHIELDING AND BONE MARROW THERAPY. S. T. Taketa, M. N. Swift, and V. P. Bond. June 12, 1958. 23p.

The efficacy of bone marrow therapy in preventing radiation mortality was compared in rats x-irradiated with three grossly different amounts of intestine surgically exteriorized and lead shielded at the 750 and 800 r dose levels, and with essentially all of the gastrointestinal tract exteriorized and shielded at doses from 1,000 to 1,400 r. The post-exposure administration of isologous bone marrow failed to enhance survival significantly following 750 to 800 r of whole-body x-irradiation, where deaths occurred predominantly during the first post-exposure week from intestinal injury, whereas significant protection was afforded by the marrow treatment in animals irradiated with portions of the intestine shielded. Shielding the gut, regardless of amount, during exposure to 750 to 800 r virtually eliminated the incidence of 3 to 5 day deaths associated with acute intestinal radiation injury. As the amount of intestinal tissue shielded was increased, the total 30-day mortality was decreased and the mean survival time of the decedents was increased. When the intestinal component of whole-body radiation syndrome was eliminated by shielding essentially all of the gastrointestinal tract during exposure to doses between 1,000 and 1,400 r, deaths attributable primarily to bone marrow damage occurred predominantly during the second post-exposure week, with peak mortality falling on days 9 and 10. The LD_{50} is increased from about 650 r for whole-body exposure to approximately 900 r by this shielding procedure. The administration of bone marrow following exposure of animals shielded in this manner raised the LD_{50} still higher to about 1,200 r; and 30% survival was obtained after 1,400 r. These data thus support the hypothesis that deaths associated with marrow damage can be prevented at x-ray doses considerably in excess of the whole-body LD_{50} dose in the rat, and that an upper limit for protection against whole-body x-radiation by bone marrow injection in this species is that dose at which the early deaths associated with gut damage, which appears to be refractive to the treatment, becomes prominent. (auth)

10328
BASIC EXPERIMENT IN RADIOLOGICAL PHYSICS. Albert A. Bartlett (Univ. of Colorado, Boulder). Am. J. Phys. 26, 281–6(1958) May.

The relationship between source strengths in millicuries and gamma-ray exposures in roentgens is dis-

cussed in terms of the definitions of these and of other basic quantities of interest in radiological physics. An experiment is discussed which serves to introduce students to these concepts and in which they can be made aware of some of the hazards of radiation exposure. (auth)

10329

RECOVERY OF ROENTGEN IRRADIATED ESCHERICHIA COLI. W. S. Moos, H. C. Mason, and H. Nodiot (Univ. of Illinois Coll. of Medicine and Illinois State Psychopathic Inst., Chicago). Am. J. Roentgenol. Radium Therapy Nuclear Med. 80, 122-5(1958) July.

The recovery effect of Escherichia coli following 4,000 r roentgen irradiation and kept at 4°C was shown to be greater in liquid than in solid media. (auth)

10330

PRESERVATION OF RADIATION RECOVERY FACTOR IN FROZEN MARROW. Joseph W. Ferrebee, Daniel Billen, Irene M. Urso, Wan Ching Lu, E. Donnall Thomas, and Charles C. Congdon (Harvard Medical School, Boston, Mary Imogene Bassett Hospital, Cooperstown, N. Y., and Oak Ridge National Lab., Tenn.). Blood 12, 1096-1100(1957) Dec.

Injection of mouse bone marrow preserved in 15% glycerol at −80°C for six weeks was shown to be quantitatively similar to injections of fresh marrow in inducing recovery in mice after lethal irradiation. The effect of the preservation procedure on subsequent rates of DNA synthesis was determined in vitro for both preserved human marrow and preserved mouse marrow. Results indicate the preservation procedure is satisfactory for the maintenance of viability in human marrow. (C.H.)

10331

EFFECT OF A DITHIOL ON SURVIVAL TIME AFTER IRRADIATION. Thomas J. Haley, Anna M. Flesher, and Nathan Komesu (Univ. of California, Los Angeles). Nature 181, 1405-6(1958) May 17.

Mice exposed to 550-r acute whole-body x irradiation were given 50 mg/kg of DL-6,8-dithiolactanoic acid, the reduced form of thioctic acid. The compound significantly increased the life span, but failed to reduce total mortality. Reaction mechanisms involved in the response to dithiol are discussed. (C.H.)

10332

EFFECTS OF ALKOXYGLYCEROLS AND ESPECIALLY SELACHYL ALCOHOL ON THE BONE MARROW IN CONNECTION WITH IRRADIATION TREATMENT AND IN LEUKAEMIA THERAPY. Astrid Brohult (Radiumhemmet, Stockholm). Nature 181, 1484-5(1958) May 24.

Alkoxyglycerols reduced leukocytopenia and thrombocytopenia when given to rats before or after irradiation. A comparative study was made of the effectiveness when administered as natural shark-liver oil and as a purified concentrate of esters. Selachyl alcohol showed more marked effects on bone marrow activity than any other constituent of the shark-liver oil. The alkoxyglycerols were tried in about thirty cases of acute leukemia in children, and some favorable responses were observed. (C.H.)

10333

ANTIBODY FORMATION IN X-IRRADIATED RATS PROTECTED WITH RAT OR RABBIT HEMATOPOIETIC CELLS. M. F. LaVia, E. L. Simmons, and J. D. Denko (Argonne Cancer Research Hospital, Chicago and Univ. of Chicago). Proc. Soc. Exptl. Biol. Med. 98, 215-18 (1958) June.

Rats given lethal doses of total-body x-irradiation were treated with liver cells obtained from rat and rabbit embryos. Two to 7 weeks after this treatment, groups of animals were stimulated with a mixture of Bovine Serum Albumin and Salmonella typhi vaccine intravenously. Rats were bled 1 week after antigen injections and titers were performed for detection of anti-typhoid and anti-BSA antibody. Rabbit-treated rats showed a positive titer to BSA and a delay in recovery of antibody-forming capacity to both antigens administered. Although rat-treated rats recovered their antibody-forming capacity earlier, they did not show any response to BSA. Possible implications of these phenomena are discussed. (auth)

10334

RADIOACTIVE PARTICLES IN THE ATMOSPHERE AT CINCINNATI, OHIO. R. Louis Bradshaw (Oak Ridge National Lab., Tenn.) and Lloyd R. Setter (Public Health Service, Cincinnati). Public Health Repts. (U. S.) 73, 431-8(1958) May.

Radioactive particles found in air samples collected in Cincinnati following nuclear detonations in Nevada were separated into two size-fractions representative of particles retained by the upper and lower respiration system of man. Measurements were made by autoradiographs and gross internal proportional counting of samples collected by a cyclone separator, which simulates capture of particles by the nasal passages and bronchial tubes. The activity of the particles collected, with one isolated exception, was below the maximum permissible level for unknown radioisotopes. Data are presented graphically. A schematic sketch of the air samples is included. (C.H.)

10335

REPORT OF THE COMMITTEE APOINTED BY THE PRIME MINISTER TO EXAMINE THE ORGANISATION FOR CONTROL OF HEALTH AND SAFETY IN THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY. Alexander Fleck. London, Her Majesty's Stationery Office, 1957. 27p. $0.24.

Recommendations are presented for additional control of health and safety in the atomic energy field in the United Kingdom. (C.H.)

10336

STUDIES OF RADIOACTIVITY IN THE CHICAGO WATER SUPPLY. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 10, Session 35. James C. Vaughn, Robert W. Schmidt, Alfred Tenny, and Arthur Shor (City Water and Sewer Dept., Chicago). New York, American Institute of Chemical Engineers, 1958. 19p.

Chicago has continuously monitored the water supply at its South District Filtration Plant for the past 6 years. For over 3 years more precise examinations have been made each day on samples of raw and treated water. The level of activity in the raw water has usually been quite low, generally less than 10^{-8} μc/ml. The ratio of raw water activity to finished water activity is shown. On very limited data the decontamination factor is 1.6 amounting to approximately 40% radioactivity removal by the usual plant treatment processes at the very low levels present. During periods when nuclear weapons are being tested, particularly following rains, the raw water activity may reach a peak of more than 10^{-7} μc/ml. This level is subject to decline due to decay and other natural causes. Some studies of the rate of decline have been made. A limited amount of work is being done to determine the specific nature of radioactivity in the lake water. Analyses for I^{131} and Sr^{90} are in progress. Preliminary results indicate the presence of I^{131} in the lake water at the expected levels. Samples of

rain and snow from rain gages located at five points throughout the City are regularly examined for radioactivity. The level of activity of these samples follows the frequency of nuclear explosions with due allowance for meteorological conditions. (auth)

Radiography

10337
THE YEAR BOOK OF RADIOLOGY. PART I. RADIOLOGIC DIAGNOSIS. PART II. RADIATION THERAPY. John Floyd Holt, Fred Jenner Hodges, Harold W. Jacox, and Morton M. Kligerman, eds. Chicago, The Year Book Publishers, Inc., 1957. 444p.

The biologic hazards of diagnostic radiography for patients and clinical personnel are discussed. Recent technical developments and applications of radiography in diagnosis and therapy are reviewed. (C.H.)

Radiotherapy

10338 ACRH-106
Argonne Cancer Research Hospital, Chicago.
PROCEEDINGS OF THE CONFERENCE ON RADIOIODINE SPONSORED BY THE ARGONNE CANCER RESEARCH HOSPITAL, UNITED STATES ATOMIC ENERGY COMMISSION, AND THE CLINICS OF THE UNIVERSITY OF CHICAGO, NOVEMBER 5 AND 6, 1956, CHICAGO, ILLINOIS. Dwight E. Clark, ed. 218p. Contract AT(11-1)-69. $3.00(OTS).

Applications of the various iodine isotopes in diagnosis and therapy are discussed. Problems of dosimetry and radiation exposure to patients and hospital personnel are considered. Some quantitative aspects of radiation damage in mammals relevant to the clinical use of radioiodine are reviewed. Emphasis is placed on applications of iodine-131 in diagnosis and therapy of hyperthyroidism and hypothyroidism; in the treatment of thyroid carcinoma; and in thyroid ablation for cardiac disease. 54 references. (C.H.)

10339 LA-2174
Los Alamos Scientific Lab., N. Mex.
EXPERIMENTAL DETERMINATION OF FAST- AND THERMAL-NEUTRON TISSUE DOSE. J. A. Sayeg, P. S. Harris, and J. H. Larkins. Jan. 1958. 65p. Contract W-7405-eng-36. $10.80(ph OTS); $3.90(mf OTS).

Beryllium-shelled tissue-equivalent and beryllium-shelled graphite ionization chambers which permit the measurement of fast- and thermal-neutron tissue dose are described. Measurements on fast neutrons (14.1-Mev and degraded fission neutrons) were compared with the Hurst proportional counter and threshold detectors. The data indicated close agreement between the different experimental systems and first-collision theory. Measurements on thermal neutrons made at the Los Alamos Water Boiler with tissue-equivalent, nitrogen-depleted, and graphite ionization chambers were in agreement with theoretical calculations on: (1) the proton portion of the total thermal-neutron dose due to the $N^{14}(n,p)C^{14}$ reaction in tissue, and (2) the gamma portion of the total thermal-neutron dose due to the $H^1(n,\gamma)H^2$ reaction in tissue. Also, the inherent gamma contamination as measured with the graphite chamber was in close agreement with the lithium extrapolation measurements of Brennan et al. The results and errors are discussed in the calculation of neutron tissue dose. (auth)

10340
RADIOACTIVE ISOTOPES. Jerome W. Bettman (Stanford Univ. Medical School). Arch. Ophthalmol. (Chicago) 59, 821-30(1958) June.

The modern ophthalmologist should have a clear concept of isotopes. For most purposes in ophthalmology pure β-ray emitters must be used. Generally, the most useful are Sr^{90} in therapy and P^{32} in diagnosis and experimental work. Radioisotopes in therapy are generally only useful for external therapy as Sr^{90} applicators or radon seeds. P^{32} has been used extensively in the diagnosis of intraocular malignancies, but its usefulness is limited. Radioisotopes are of the greatest help in investigative work and have been responsible for much of our understanding of the intraocular fluids: This includes present concepts of formation of the aqueous, factors influencing intraocular blood volume, the movements of fluids through such ocular tissues as the cornea and the lens, and the distribution of various ions in ocular structures. (53 references). (C.H.)

10341
THE ASCLEPITRON, A MEDICAL APPLICATION OF THE 31 Mev BETATRON. L. Pittet. Minerva nucleare 2, 67-74(1958) Mar. (In Italian)

A modification of the 31-Mev betatron is presented, specially designed for therapeutic applications. The therapeutic advantages of high-energy radiations are briefly discussed. This new type of betatron, called the "asclepitron," is described, and its most useful characteristics as regards deep radiation therapy are stressed. (auth)

Toxicology Studies

10342 UR-522
Rochester, N. Y. Univ. Atomic Energy Project.
THE LIMITATIONS OF URINARY RADIUM AS A MEASURE OF RADIUM BODY LOAD. John B. Hursh. Feb. 18, 1958. 12p. Contract W-7401-eng-49. $0.50 (OTS).

Since the radium content of the urine from industrially exposed workers will depend mostly on their very recent exposure history, measurement of urine samples alone does not determine radium body burden. The method may be used to monitor working environment and spot accidents but must be supplemented by radon breath samples if body burden data are to be obtained. (auth)

10343
SODIUM—POTASSIUM ALLOY. AN EXPERIMENTAL STUDY OF ITS HAZARDS. Asher J. Finkel and Willard B. Lyons (Argonne National Lab., Lemont, Ill.). Arch. Ind. Health 17, 624-33(1958) June.

The thermal, chemical, and radiation hazards of liquid sodium—potassium alloy (NaK) have been reviewed and the nature of the therapeutic problems has been evaluated. Experiments with an artificial indicator system were performed in a study of the penetration of test films by NaK. In the light of these investigations it is suggested that 1.0 to 2.5% stearic acid in light mineral oil may be effective in retarding the reactivity of the NaK with water on and in the skin. Skin and hair covered with NaK or sodium metal should be flooded with the oil preparation and the alkali metal brushed or gently scraped off with a metal spatula. Disposal of the alkali metal should be accomplished by allowing it to react with butyl alcohol. The use of water should be avoided until the alkali metal is removed from

the surface of the body. Appropriate surface active agents added to the mineral oil may enhance its control over NaK reactivity. (auth)

10344

RADIUM (Ra^{226}) AND RADON (Em^{222}) METABOLISM IN DOGS. M. A. Van Dilla, B. J. Stover, R. L. Floyd, D. R. Atherton, and D. H. Taysum (Univ. of Utah, Salt Lake City). Radiation Research 8, 417-37(1958) May.

The metabolism of radium in beagle dogs after a single intravenous injection was studied. Radon exhalation in dogs was compared with radon exhalation data for other species, and a theoretical method for calculating radon retention and excretion ratios is presented. The metabolism of radium and calcium-45 in dogs was compared, and considerable differences were found in renal clearance rates, plasma levels, and skeletal binding. Radium retention in beagles was found to decrease as age at injection increased. Calculations of average radiation dosage from deposited radium in beagles are compared with dosage measurements made on humans. (C.H.)

10345

DETECTION OF PLUTONIUM CONTAMINATION IN HUMANS BY THE AUTORADIOGRAPHIC METHOD. N. L. Dockum, E. J. Coleman, and G. Vogt (General Electric Co., Richland, Wash.). Stain Technol. 33, 137-42(1958) May.

The autoradiographic technique, using 5 μ paraffin sections in contact with 5 μ NTA emulsion for 10 hr and similar sections of sputum for 3 days, was found to be more sensitive for detecting contamination with Pu^{239} than tests with a scintillation counter. Both human and pig skin were tested. The autoradiograms showed characteristic alpha tracks in the emulsion at sites of Pu deposition following its uptake either in solution or in particulate form. Autoradiography is recommended as a routine method to supplement information gained from chemical analyses and counting procedures. (auth)

Tracer Applications

Refer also to abstract 10827.

10346 TID-3512

Technical Information Service Extension, AEC. ISOTOPE TECHNIQUES IN BIOLOGICAL SCIENCES. A Selected List of References. J. A. McCormick, comp. Feb. 1958. 44p. $1.25(OTS).

This bibliography contains 807 selected references on techniques for the use of radioactive and stable isotopes in biological sciences. These references were taken from the 1948 to 1956 open literature. A list of the journals from which they were selected and an author index are also included. (auth)

10347

THE USE OF RADIOACTIVE ISOTOPES IN IMMUNOLOGICAL INVESTIGATIONS. THE ROLE OF LEUCOCYTES AND NON-PLASMA ANTIBODY IN THE REMOVAL OF ANTIGENIC PROTEINS FROM THE BLOOD STREAM OF IMMUNIZED RABBITS. G. E. Francis and J. D. Hawkins (St. Bartholomew's Hospital, London). Biochem. J. (London) 69, 287-97(1958) June.

Bovine plasma albumin and horse serum labeled with iodine-131 were employed in studies on the behavior and elimination of intravenously injected native proteins in normal and immune rabbits. Actively, but not passively, immunized rabbits can eliminate rapidly from their blood more antigen than their sera can precipitate in vitro, except when they have been in the immune state for a long time. When immune rabbits are given an injection of antigen sufficient to react with all the antibody in their plasma, a second small injection of antigen is eliminated from the blood more rapidly than a similar dose injected into normal rabbits. There is evidence for deposition of part of the second injected dose in the liver, lungs, and spleen of the immune rabbits. The significance of these observations is discussed and it is concluded that some non-plasma antibody is partly responsible for the immune responses observed when an antigen is injected into specifically immunized rabbits. This non-plasma antibody is unlikely to be mainly in the lymphocytes or lymphoid tissue. Injection of antigen into immune, but not into normal, rabbits causes a profound leucopenia, which is due to a fall in the numbers of both lymphocytes and granulocytes. This phenomenon is not modified by the prior injection of cortisone in amounts sufficient to cause a lymphocytopenia. (C.H.)

10348

REMOVAL OF Ca^{40} AND Ca^{45} FROM BONE BY CITRATE AS INFLUENCED BY THE PARATHYROIDS. J. R. Elliott and Roy V. Talmage (Rice Inst., Houston, Texas). Endocrinology 62, 709-16(1958) June.

The effects produced by the introduction of exogenous citrate in a neutralized rinsing fluid into the peritoneal cavities of nephrectomized and parathyroidectomized-nephrectomized male rats were followed through the technique of peritoneal lavage. Both groups of animals showed progressive increases in wash calcium when as little as 15 to 25 mg of critric acid were added per 100 ml of rinsing fluid. Peritoneal equilibration for one and one-half hours instead of one hour increased the amounts of calcium removed in the wash. Parathyroidectomized rats given the same amounts of citrate as control rats showed lower total wash calcium values; however, the increases in both groups were relative when compared to their citrate-free rinse values. The addition of citric acid did not appreciably alter the amount of radiocalcium removed in the wash when the radioactivity was administered within twenty-four hours of the start of the lavage. Therefore, because of the increase in the total calcium removed, the specific activity of the radiocalcium in the peritoneal wash fell markedly following the citric acid administration. The experiments are interpreted as showing that citric acid mobilizes calcium from the deep areas of bone, as does the hormone of the parathyroids, and not from those areas which are in close contact with the extracellular fluid compartments. No explanation of this phenomenon can be given as yet. (auth)

10349

REMOVAL OF CALCIUM FROM BONE AS INFLUENCED BY THE PARATHYROIDS. Roy V. Talmage and J. R. Elliott (Rice Inst., Houston, Texas). Endocrinology 62, 717-22(1958) June.

A study was made of the relative removal of radiocalcium and stable calcium by continuous peritoneal lavage in the rat, as influenced by the hormone of the parathyroids. The lavage procedure involved the use of male rats weighing between 225 and 275 gm which had been maintained 48 hours on a calcium free diet and had been nephrectomized 24 hours before experimental use. Parathyroidectomy was performed without interruption of the lavage procedure. The results indicated that if the radiocalcium was injected into the animals less than 24 hours before the lavage treatment, the radioactivity removed by this method was not affected by parathyroidectomy. This was in spite of the fact that the operation caused an immediate drop in the total calcium concentrations of the lavage washes. If, however, the

radiocalcium was injected two to three weeks before the continuous lavage was performed, the radiocalcium concentrations of the wash parallel those of the stable calcium, both falling after parathyroidectomy. These data are construed to indicate that a basic equilibrium exists between the extracellular spaces and those portions of the bone with which the fluid is in ready contact, and that this equilibrium maintains the constant low concentration of calcium in the fluid spaces. It is further postulated that, in addition to this basic equilibrium, parathyroid hormone supplies calcium to the fluid spaces from areas of bone that are not in immediate contact with the surrounding fluid media, and that this is done through metabolic processes in bone cells which enables calcium to be dissolved in concentrations greater than the solubility of apatite crystals. (auth)

10350

BLOOD CLEARANCE AND TISSUE DISTRIBUTION STUDIES IN THE DOG FOLLOWING INTRAVENOUS ADMINISTRATION OF RADIOACTIVE COLLOIDAL GOLD (AURCOLOID). Aaron Ganz and Marshall Brucer (Univ. of Tennessee, Memphis and Oak Ridge Inst. of Nuclear Studies, Tenn.). J. Lab. Clin. Med. 52, 20-6 (1958) July.

A study of the fate of intravenously administered radioactive colloidal gold (Aurcoloid) in the dog is presented with statistical evaluation of the results. The liver is of predominant importance with respect to systemic uptake, accumulating approximately 94% of the injected dose. Only liver, spleen, and bone marrow appear to have the ability to concentrate significant amounts of the injected colloid. The injected material disappears very rapidly from the circulating blood stream in an essentially smooth, two-phase process. The effective particle size of the gold colloid used (Aurcoloid) appears to be about 40 mμ. Comparisons of our results with those of other investigators are discussed. (auth)

10351

DEVELOPMENT OF A RADIOISOTOPE TRACER TEST FOR THE DIFFERENTIAL DIAGNOSIS OF JAUNDICE. THE ROSE BENGAL I^{131} HEPATOGRAM. George V. Taplin, Orsell M. Meredith, Jr., and Harold Kade (Univ. of California, Los Angeles and Los Angeles County Harbor General Hospital, Torrance, Calif.). J. Louisiana State Med. Soc. 109, 255-66(1957) July.

The Rose Bengal iodine-131 hepatogram measures liver vascularity, polygonal cell function, biliary tract patency and bile flow interference directly. It is performed externally using the same standard radiation detection equipment as routinely employed in iodine-131 uptake tests for thyroid diagnosis. Results are reproducible, and normal subjects have characteristic hepatograms which are distinctly different from those found in patients with a variety of hepatobiliary disorders. Test procedures are described. Results of single and repeated hepatograms in patients and animals having a variety of liver-biliary tract disorders are interpreted. (C.H.)

10352

DETECTION OF MINUTE GASTROINTESTINAL BLEEDING UTILIZING RADIOACTIVE IRON, Fe^{59}. Earl G. Yonehiro, Harlan D. Root, John F. Perry, Jr., James F. Marvin, and Owen H. Wangensteen (Univ. of Minnesota Medical School, Minneapolis). Proc. Soc. Exptl. Biol. Med. 98, 339-41(1958) June.

Excretion patterns of intravenously administered radioactive iron in the stool of normal dogs and in dogs with histamine-induced bleeding of the gastrointestinal tract were compared. Levels of stool radioactivity were measured following intragastric administration of known amounts of isotope-labelled blood. Radioactivity in the stool can be utilized for detection of occult bleeding. Comparative evaluation following administration of known small quantities of isotope-labelled blood (Fe^{59}) indicates definitely that this test is considerably more sensitive than the guaiac test. (auth)

10353

ADAPTATION OF POLAROID X-RAY PAPER PRINTS TO RADIOISOTOPIC SCANNER TECHNICS. Isadore Meschan (Wake Forest Coll., Winston-Salem, N. C.) and C. Fred Taylor (North Carolina Baptist Hospital, Winston-Salem). Radiology 70, 868-9(1958) June.

A technique is described for utilizing a polaroid radiograph as the background for the hash-mark type of scanogram which accurately depicts the localization of isotopes in nodules, for example in the thyroid gland, in relation to the rest of the structure. It is also possible to determine accurately the localization with reference to the manubrium or the substernal area. This method of obtaining scanograms is believed to be an improvement over merely indicating by crude adaptation certain landmarks in relation to the various scans obtained. (auth)

10354

EFFECT OF CALCIUM ON DEPOSITION OF STRONTIUM-90 AND CALCIUM-45 IN RATS. Ray. F. Palmer, Roy C. Thompson, and Harry A. Kornberg (General Electric Co., Richland, Wash.). Science 127, 1505-6(1958) June 27.

Three groups of 16 mature female rats were maintained for 30 days on diets containing 0.5% phosphorus, and 0.1, 0.5, or 2.0% calcium. After this 30-day conditioning period, strontium-90, calcium-45, and insoluble chromium oxide labeled with Cr^{51} were added to the diets. Four animals from each group were sacrificed after 3, 6, 13, or 24 days on the labeled diet. One femur and a blood sample were assayed for calcium-45 and strontium-90. Total calcium and phosphorus were determined in the second femur. Food consumption was estimated from measurements of chromium-51 in the total feces and contents of the gastrointestinal tract. Data are tabulated. Within each dietary group there was a trend toward lower values for the Sr^{90}/Ca^{45} ratio as time on the labeled diet increased. The effect of dietary calcium levels on strontium-90 bone uptake is discussed. (C.H.)

CHEMISTRY

10355 CF-58-6-6

Oak Ridge National Lab., Tenn.

ESTIMATE OF THE PROBABILITY AND CONSEQUENCES OF IGNITION OF THE HRT CHARCOAL BEDS. R. E. Adams and W. E. Browning. June 3, 1958. 11p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80 (mf OTS).

The ignition temperature of Columbia G activated charcoal in a flowing oxygen stream was determined to be 290°C under conditions simulating the inlet of the HRT charcoal beds. Calculations of charcoal temperatures resulting from beta decay of adsorbed fission gases from the HRT indicate that this temperature will not be reached provided the reactor power does not exceed 10 Mw with an accompanying oxygen flow not exceeding 2 liters/min. At lower power levels higher oxy-

gen flow may be tolerated. If, by a combination of circumstances, ignition of the charcoal should occur, it will be possible to extinguish the fire by stopping the oxygen flow. The down-stream propagation of the combustion front is slow enough to allow detection and corrective action to be taken before a serious situation occurs. (auth)

10356 ISC-921
Ames Lab., Ames, Iowa.
ANNOTATED BIBLIOGRAPHY OF ALPHA, BETA, GAMMA, DELTA-TETRAPHENYLPORPHINE.
Charles V. Banks and Samuel Anderson. Oct. 1957. 17p. Contract W-7405-eng-82. $0.50(OTS).

The references in this bibliography deal with the methods of preparation and purification of alpha, beta, gamma, delta-tetraphenylporphine, the properties of some of its metal complex salts, and its analytical applications. The references are listed chronologically. (auth)

10357 NBS-5039
National Bureau of Standards. Cryogenic Engineering Lab., Boulder, Colo.
EPOXY RESINS AS CRYOGENIC STRUCTURAL ADHESIVES. R. M. McClintock and M. J. Hiza. [1956?]. 11p. $3.30(ph OTS); $2.40(mf OTS).

An investigation of copper to copper bonds using filled epoxy resins as adhesives was undertaken to provide design data for a liquid H_2-cooled electromagnet. The adhesives studied were epoxy resin paste with liquid amine curing agent and 55% alumina as filler. (T.R.H.)

10358 NLCO-728
National Lead Co. of Ohio, Cincinnati.
MAGNESIUM FLUORIDES—A LITERATURE SEARCH. Earl W. Mautz. Apr. 4, 1958. 9p. Contract AT(30-1)-1156. $0.50(OTS).

A literature search on "Magnesium Fluorides" from Chemical Abstracts and U.S.A.E.C. Abstract services is presented. The subheadings excluded were: mineralogy, MgF_2—metal fluoride and oxide systems, use as optical glass coating, effects on Al_2O_3 and electrolytic baths, crucibles from, precipitation of, adsorption of UF_4 by, and solubility in hydrochloric and nitric acids. (auth)

10359 NLCO-729
National Lead Co. of Ohio, Cincinnati.
A LITERATURE SURVEY ON THE PHYSICAL CHEMISTRY, ANALYSIS AND RECOVERY AND/OR DISPOSAL OF HYDROFLUORIC ACID. Earl W. Mautz. Apr. 4, 1958. 25p. Contract AT(30-1)-1156. $0.75(OTS).

A listing of literature references relating to the physical chemistry, analysis, and recovery and/or disposal of anhydrous and aqueous hydrofluoric acid is reported. (auth)

10360 NLCO-730
National Lead Co. of Ohio, Cincinnati.
THE SOLUBILITIES OF KF, NaF, AND NH_4F IN H_2O, THEIR RESPECTIVE HYDROXIDES—H_2O, AND HF—H_2O SYSTEMS. A COMPILATION OF DATA FROM THE LITERATURE. Earl W. Mautz. Mar. 26, 1958. 13p. Contract AT(30-1)-1156. $0.50(OTS).

Available data from the literature are tabulated for the systems KF—H_2O, KF—HF—H_2O, NaF—H_2O, NaF—NaOH—H_2O, NaF—HF—H_2O, NH_4F—H_2O, and NH_4F—HF—H_2O. (auth)

10361 NP-6714
Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.
INTERNAL PHOTOEFFECT AND EXCITON DIFFUSION IN CADMIUM AND ZINC SULFIDES. Technical Report No. 123. M. Balkanski and R. D. Waldron. Nov. 1957. 44p. Contract Nonr-1841(10).

The spectral response of photoconductivity of ZnS and CdS for both single-crystal and sintered-powder samples was measured for several distances between the area of illumination and the electrode region. The energy transport process for indirect illumination was studied by measuring the photocurrent pulses produced by high intensity light flashes and by experiments with light transmission and electric fields. These studies demonstrate energy transport by electrically neutral entities other than photons, which are interpreted as diffusion of excitons or mobile electron-hole pairs. (auth)

10362 NP-6735
Olin Mathieson Chemical Corp., Niagara Falls, N. Y.
CURRENT LITERATURE ABSTRACTS BULLETIN. VOL. 7, NO. 5. May 1958. 147p.

This bulletin consists of 120 abstracts from the current literature on boron compounds. (W.L.H.)

10363 NP-6760
Olin Mathieson Chemical Corp., Niagara Falls, N. Y.
CURRENT LITERATURE ABSTRACTS BULLETIN. Volume 7, Number 1. Jan. 1958. 31p.

This bulletin consists of 75 abstracts from the current literature on boron compounds. (W.L.H.)

10364 NP-6761
Olin Mathieson Chemical Corp., Niagara Falls, N. Y.
CURRENT LITERATURE ABSTRACTS BULLETIN. Volume 7, Number 2. Feb. 1958. 29p.

This bulletin consists of 80 abstracts from the current literature on boron compounds. (W.L.H.)

10365 NRL-5121
Naval Research Lab., Washington, D. C.
SODIUM SILICATES FOR THE CO_2 PROCESS. E. A. Lange and R. E. Morey. Feb. 20, 1958. 19p. Projects NR-511-000 and NS-014-100.

The chemistry of the CO_2—sodium silicate process for bonding foundry sand was investigated with particular attention given to the composition of the sodium silicate, CO_2 utilization, and drying procedures. The rate at which strength develops with CO_2 is dependent on the SiO_2/Na_2O ratio of the sodium silicate; and the maximum strength developed with CO_2, which can be as high as 500 psi, is dependent on the SiO_2/H_2O ratio of the sodium silicate. Drying ungassed sand mixtures will produce strengths in excess of 2000 psi but the dry strength of sand which has been gassed with CO_2 is dependent upon the composition of the sodium silicate and the gassing time; dry strength can be less than the gassed strength. The amount of CO_2 necessary to develop maximum gassed strength is that required to increase the SiO_2/Na_2O ratio of the sodium silicate to 4. However, at low CO_2 flow rates, the sodium silicate will absorb an amount of CO_2 equivalent to 1.0 to 1.5 times the amount of Na_2O present. The efficiency of the CO_2 gassing process can be greatly increased by diluting the CO_2 with air. (auth)

10366 UCRL-5065
[California. Univ., Livermore. Radiation Lab.]
BERYLLIUM-OXIDE. A Bibliography. Maggie Cason. Mar. 22, 1957. 5p. Contract [W-7405-eng-48]. (M-6298). $1.80(ph OTS); $1.80(mf OTS).

This bibliography consists of published literature references selected from the following sources: Chemical Abstracts, 1951 to 1955; Physics Abstracts, 1951 to 1955; Industrial Arts Index, 1955 to Jan. 1957; and the library card catalog. (L.T.W.)

10367 UCRL-5227
California. Univ., Livermore. Radiation Lab.
FUSED LITHIUM SALTS: A BIBLIOGRAPHY COVERING 1950-57. Dorothy Baughman and G. R. Maynard. May 19, 1958. 13p. Contract W-7405-eng-48. $3.30 (ph OTS); $2.40(mf OTS).

10368 WAL-TR-541/1
Watertown Arsenal Lab., Mass.
SOLUBILITY RELATIONSHIPS IN THE TITANIUM-HYDROGEN SYSTEM AND NON-STOICHIOMETRY OF TITANIUM HYDRIDE. Arthur Kant. May 1958. 18p. DA Project No. 599-01-004.

It is shown that the pressure, temperature, composition relationships for the hydrogen-titanium system, developed on the basis of a statistical model previously employed for the zirconium-hydrogen system, satisfy the experimental data. The stoichiometry of gamma-phase titanium is explained quantitatively by the assumption of equilibrium vacancies in an expanded titanium lattice. The heat of formation of TiH_2 (gamma phase) is calculated on the basis of the model to be −32.9 k. cal/mol. (auth)

10369 AEC-tr-3237
TEXTURE EFFECT ON THE ANODIC BEHAVIOR OF COPPER IN SOLUTIONS OF CERTAIN ELECTROLYTES. F. F. Faizullin, I. P. Desider'eva, and N. E. Timoshenko. Translated from Uchenye Zapiski, Kazan. Gosudarst. Univ. im. V. I. Ul'yanova-Lenina 115, 123-37(1955). 20p.

A study was made of the anodic polarization of textured (texture axis 011) and non-textured galvanic copper precipitates in 1 N $CuSO_4$, 1 N $CuSO_4$ + 20 g/l H_2SO_4, 1 N H_2SO_4, and 1 N $Cu(NO_3)_2$ solutions at 20°C. It has been established that in all the solutions except the first, the dynamic potentials of textured copper are more positive than those of the non-textured copper. It was found that in all the solutions in which the textured copper potential was more positive than the non-textured one, the anodic dissolution rate of textured copper is less than that of non-textured copper. A study has been made of the anodic oxidation rate of textured and non-textured copper precipitates in a NaOH solution at temperatures of 0, 20, 30, 40, 50, and 60°C and at other current densities (0.57 and 1.1 a/dm^2). It was established that at all temperatures the anodic oxidation rate of textured copper is greater than the oxidation rate of non-textured copper. (auth)

10370 AEC-tr-3251(Pt. 1)
THE THEORY OF DIFFUSED KINETICS OF HETEROGENEOUS CHEMICAL PROCESSES. I. REACTIONS OCCURRING AT THE SOLID-LIQUID SEPARATION BOUNDARY. V. Levich. Translated from Zhur. Fiz. Khim. 22, 575-85(1948). 18p. (AEC-tr-1481).

A quantitative theory of the rate of heterogeneous chemical transformations in the diffused (or intermediate) region is proposed for reactions occurring at the solid-liquid interface. (T.R.H.)

10371 AEC-tr-3251(Pt. II)
THEORY OF DIFFUSED KINETICS OF HETEROGENEOUS CHEMICAL PROCESSES. II. REACTIONS O OCCURRING AT THE SOLID-LIQUID SEPARATION BOUNDARY DURING TURBULENT FLOW. V. Levich. Translated from Zhur. Fiz. Khim. 22, 711-19(1948). 14p.

10372
THE VAPOR PRESSURE OF LITHIUM IN THE REDUCTION OF LITHIUM OXIDE BY SILICON. W. Morris and L. M. Pidgeon (Univ. of Toronto, Ont., Can.). Can. J. Chem. 36, 910-14(1958) June.

The vapor pressure of lithium over the system lithium oxide-calcium oxide-silicon has been measured using the gas entrainment method at temperatures between 970 and 1025°C. The experimental results are summarized in the form $4 \log P = 43.1 - (6.69/T) \times 10^4$ where P is in atmospheres and T in °A. (auth)

10373
THE COMPOSITION OF THE LUMINESCENCE CENTER OF SODIUM FLUORIDE BEADS ACTIVATED BY URANIUM. T. S. Dobrolyukskaya (Vernadsky Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR, Moscow). J. Anal. Chem. U.S.S.R. (English Translation) 11, 1-6(1956) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 10, as abstract No. 7523.

10374
CHEMICAL EFFECTS OF PHOTONUCLEAR REACTIONS IN THE PROPYL BROMIDES. A. E. Richardson and A. F. Voigt (Iowa State Coll., Ames). J. Chem. Phys. 28, 854-63(1958) May.

Two new photonuclear reactions are reported, $Br^{79}(\gamma,2n)Br^{77}$ and $Br^{79}(\gamma,3n)Br^{76}$. The organic retention following the $Br^{81}(\gamma,n)Br^{80m}$ reaction in liquid n- and isopropyl bromides was found to be 47 and 36%, respectively, appreciably higher than reported values following the $Br^{79}(n,\gamma)Br^{80m}$ reaction. Higher retentions were also noted for irradiations of the solid bromides. The relative yields of individual organic products were determined for irradiations of both liquid and solid and were in many respects in striking agreement with data from activation by (n,γ) reaction and isomeric transition. In solid n-propyl bromide the (γ,n) and $(\gamma,3n)$ reactions gave the same ratio of parent compound to total organic yield. Data on the scavenger effect show that thermal recombination reactions occur in both liquid and solid. Marked increases are shown in the thermal organic yield with only slight increases in the nonthermal retention for both bromides for (γ,n) compared to (n,γ) activation. The reasons for these increases are discussed. In general, the data indicate that elastic collision mechanisms are unimportant compared to random fragmentation as an explanation of the results. (auth)

10375
SPECTRAL COMPARISON OF POLYENES, CUMULENES, AND POLYYNES. Helmut Krauch (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 28, 898-9 (1958) May.

If a double bond is introduced between two double bonds of a conjugated polyene to form a cumulene the λ maximum shifts by 34 mμ to longer wavelength. The conjugation is much smaller in polyacetylenes than in polyenes. The formulation of a cumulene structure for the ground state of long polyacetylenes seems to be incorrect. (auth)

10376
THE SZILARD-CHALMERS REACTION IN FERROCENE. N. Sutin and R. W. Dodson (Brookhaven National Lab., Upton, N. Y.). J. Inorg. & Nuclear Chem. 6, 91-8(1958) Apr.

The products of the Szilard-Chalmers reaction in ferrocene were separated by solvent extraction and chromatography. For samples irradiated in the center of the Brookhaven Reactor about 12% of the Fe^{59} activity is found in the form of the parent compound. The yield is increased to about 21% by heating the irradiated samples. The yield of inorganic radioactive iron is decreased by thermally annealing the irradiated crystals; this effect appears to depend on the fast-neutron

dose received by the sample during activation. The distribution of radioactive products is not altered by exposing the sample to large doses of γ-radiation after activation in the reactor. An explanation of the results is offered, which suggests that the following types of fragments are formed in the crystals during pile-irradiation: free iron atoms or ions and iron-monocyclopentadienyl radicals as primary disruption products in the (n,γ) processes; free cyclopentadienyl radicals, C_5H_5; and organic radicals formed by rupture of the C_5H_5 rings in ferrocene when fast neutrons are present. (auth)

10377

HYDRIDE-TRANSFER REACTIONS OF BORINE. I. SYNTHESIS OF BORON-CARBON BONDS FROM THE FLUOROETHYLENES. Bodo Bartocha, W. A. G. Graham, and F. G. A. Stone (Harvard Univ., Cambridge, Mass.). J. Inorg. & Nuclear Chem. 6, 119-29(1958) Apr.

The effect of diborane on four fluoroethylenes: tetrafluoroethylene, trifluoroethylene, 1:1-difluoroethylene and vinyl fluoride, was studied at ordinary and higher temperatures. The reactions follow an essentially similar course, and in all cases complex mixtures are obtained. Fluorine in the ethylenes is first replaced by hydrogen, and boron in the products appears mainly as boron trifluoride, ethylboron difluoride, diethylboron fluoride and triethylboron. In the diborane-tetrafluoroethylene reaction polymerization of the olefin takes place with incorporation of some boron in the polymer. Moreover, distribution of boron in the volatile products is in the order $BF_3 > EtBF_2 \gg EtBF_2 > Et_2BF$. This order changes as the fluorine content of the olefin decreases. Thus with vinyl fluoride it is, $EtBF_2 > Et_2BF \gg BF_2 \sim Et_3B$. The ethylboron fluorides are the main product of the reaction between tetrafluoroethylene, diborane and triethylboron. Under conditions similar to those in which fluoroethylenes underwent complete reaction, diborane failed to react with saturated fluorocarbons such as ethyl fluoride. A possible mechanism for the reactions between diborane and the fluoroethylenes is discussed. (auth)

10378

THE REACTION OF ALUMINIUM BOROHYDRIDE WITH TIN AND LEAD TETRAMETHYL. A. K. Holliday and W. Jeffers (Univ. of Liverpool). J. Inorg. & Nuclear Chem. 6, 134-7(1958) Apr.

Tin and lead tetramethyl do not react with diborane but both react vigorously with aluminum borohydride giving solid products which decompose ultimately to tin or lead, hydrogen, methylated boranes and methyl aluminum borohydride, $MeAl(BH_4)_2$. No dimethyl aluminum borohydride or trimethyl aluminum are found. The nature of the decomposition products suggests the intermediate formation of compounds such as $Me_2Sn(BH_4)_2$ and Me_3PbBH_4, but there is no evidence for replacement of more than two methyls by borohydride groups. Possible explanations are given for the limitations observed in the replacement of borohydride by methyl groups, and vice versa. (auth)

10379

MISCIBILITY OF METALS WITH SALTS IN THE MOLTEN STATE. III. THE POTASSIUM-POTASSIUM HALIDE SYSTEMS. J. W. Johnson and M. A. Bredig (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 62, 604-7 (1958) May.

Complete miscibility of metal and salt exists in the potassiumX-K systems, X = fluorine, chlorine, bromine, and iodine, at and above 904, 790, 727, and 717°, i.e., as close as +47, +18, −7, and +22 deg., respectively, to the melting points of the salts. Probably because of the smaller difference in cohesive energies of the two components, the potassiumX-K systems are thus considerably less non-ideal than the sodiumX-Na systems. The asymmetry of the liquid-liquid coexistence areas, especially of the fluoride and chloride systems, as indicated by the consolute compositions 20, 39, 44, and 50 mole % metal, respectively, is largely explained by the difference in molar volumes of salt and metal, which seems to cause the component with the smaller volume to be more soluble in the liquid phase of the other component than vice versa. At the monotectic temperature, the solubility of the solid salts in the liquid metal, as well as of the metal in the liquid salt phase, is much larger than in the case of the sodium systems. Through a relatively low consolute temperature and smaller area of immiscibility in liquid phase, the bromide system exhibits a lower degree of non-ideality than either the chloride or the iodide system. The upward curvature of the liquidus curves between the melting points of the salts and the monotectics corresponds to strong positive deviation from Raoult's law for the major component, the salt. Association of the metal, possibly involving—as an intermediate stage—K_2 molecules known to exist in the vapor, would account for this effect. (auth)

10380

THERMODYNAMIC STUDIES OF SOME GASEOUS METALLIC CARBIDES. William A. Chupka and Joseph Berkowitz (Argonne National Lab., Lemont, Ill.) and Clayton F. Giese and Mark G. Inghram (Univ. of Chicago). J. Phys. Chem. 62, 611-14(1958) May.

A mass spectrometric search has been made for gaseous metallic carbides in equilibrium with the corresponding metal vapor and graphite, for the systems Al−C, Be−C, Ga−C, La−C, and Ti−C. The molecules Al_2C_2, Ga_2C_2, and LaC_2 have been identified in these studies, as well as Ga_2 and probably Al_2. A thermodynamic treatment of the data has yielded heats of formation for these molecules, which provides evidence for the similarity of $M-C_2$ bonding to M−O bonding, and hence indicates strong ionic contributions. (auth)

10381

THERMAL EXPANSION OF SOME TRANSITION METAL CARBIDES. Reed O. Elliott and Charles P. Kempter (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 62, 630-1(1958) May.

The physical and chemical properties of some transition metal carbides were determined, and it is concluded that for a given temperature range, the linear thermal expansion of titanium carbide, zirconium carbide, niobium carbide, and tantalum carbide decreases with increasing weight, and for a given temperature range the melting point is almost constant. (J.R.D.)

10382

THE HEATS OF SUBLIMITATION OF INORGANIC SUBSTANCES. PART 5. THE ALKALI METAL FLUORIDES. A. C. P. Pugh and R. F. Barrow (Oxford Univ.). Trans. Faraday Soc. 54, 671-8(1958) May.

The vapor pressures of the alkali metal fluorides and of potassium chloride were measured in the range 10^{-4} to 10^{-2} mm mercury using a torsion fibre effusion apparatus. The results may be interpreted as indicating that there is a significant degree of dimerization in gaseous lithium and sodium fluorides under these conditions. T The following values of the latent heats of sublimation, $\Delta_s H_{298}$ (MX), are obtained: LiF 66·3, NaF 67·3$_5$, KF 57·8, RbF 54·9, CsF 49·1, KCl 52·8$_5$ kcal/mole^{-1}. (auth)

10383
ON THE LIMITS OF APPLICABILITY OF THE FIRST ORDER KINETIC EQUATION FOR ISOTOPIC EXCHANGE. Ya. M. Varshavskii and S. E. Vaisberg (Karpov Inst. of Physical Chemistry, Moscow). Zhur. Fiz. Khim. 32, 454-9(1958) Feb. (In Russian)

The deviation of isotopic-exchange reactions from first order has been examined on a bimolecular reaction as example. The maximum deviations of the practically possible distribution coefficient values have been calculated over the entire range of component and isotope concentrations. (tr-auth)

10384
STUDY OF INTERACTION OF CHLORIDES OF ALKALI EARTH METALS IN MELTS. III. STUDY OF INTERACTION OF SODIUM, POTASSIUM, CALCIUM, CESIUM, RUBIDIUM, AND LITHIUM CHLORIDES IN MELTS. V. Ye. Plyuchchev, L. N. Komissarova, L. V. Meshchaninova, and L. M. Akulkina. Zhur. Neorg. Khim. 1, No. 4, 820-33 (corrections in No. 12, 2874) (1956). (Translated from Referat. Zhur. Khim. No. 8, 1957, Abstract No. 26145.)

Aerosols

10385 SCL-T-188
ON THE DIFFUSION OF DUST AND GASES FROM CHIMNEY-STACKS. (O Rasprostranenii Pyli i Gazov iz Dymovykh Tryb.) A. I. Denisov. Translated by M. I. Weinreich from Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz., No. 6, 834-7(1957). 9p.

Formulas are presented for use in calculating the atmospheric diffusion of dust and gases ejected from smokestacks. (C.H.)

Analytical Procedures

Refer also to abstract 10521.

10386 HW-28530
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
SPECTROGRAPHIC ANALYSIS OF PLUTONIUM BY THE THENOYLTRIFLUOROACETONE EXTRACTION METHOD. H. H. Van Tuyl. June 29, 1953. Decl. June 3, 1958. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Impurities are separated from plutonium solutions by means of TTA (thenoyltrifluoroacetone) extractions. Plutonium in hydrochloric acid solution is reduced to the trivalent state with hydroxylamine, and some impurities are extracted into hexone or a solution of TTA in hexone. The organic phase is removed, and the plutonium in the aqueous phase is oxidized to the tetravalent state with nitric acid. The plutonium is then extracted into TTA in hexone, and most of the impurities remain in the aqueous phase. The organic phase of the plutonium(III) extraction and the aqueous phase of the plutonium(IV) extraction are then analyzed by the copper spark spectrographic method. Investigations of several variables which affect the extraction are described. Analytical results by this methods are compared with those by the carrier distillation and cupferron extraction methods. The distribution of over 60 elements in these extractions is listed. (auth)

10387 IDO-14435
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
AN EXTRACTION, CONTROLLED-POTENTIAL COULOMETRIC METHOD SPECIFIC FOR URANIUM(VI). Glenn L. Booman and Wayne B. Holbrook. Apr. 8, 1958. 21p. Contract AT(10-1)-205. $4.80 (ph OTS); $2.70(mf OTS).

A method, specific for uranium, is based on methyl isobutyl ketone separation of tetrapropylammonium uranyl trinitrate from acid-deficient aluminum nitrate solution followed by direct coulometric reduction of uranium(VI) at a mercury cathode. Perchloric acid volatilizes ruthenium and technetium which are the only known interfering species extracted with uranium. The uranium is determined by controlled potential reduction of the citrate complex after a pre-reduction step to eliminate easily reducible material. The complete procedure requires approximately 2.5 hours. Results on samples from solutions of freshly dissolved aluminum-uranium fuel elements having about 20% burnup show excellent precision and no bias as compared to the isotope-dilution thermal mass spectrometric method. Experimental data indicate a trimolecular uranyl-citrate-aluminum complex with each citrate molecule forming two six-membered rings with the uranyl ion. (auth)

10388 IGO-AM/CA-110
United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.
THE ANALYSIS OF SODIUM METAL AND SODIUM–POTASSIUM ALLOY (COLLECTED CAPENHURST METHODS). Mar. 1958. 59p.

Various methods for the sampling of sodium or sodium–potassium alloys from storage drums or similar containers are outlined. A sample is withdrawn from the bulk storage container by means of a suction pump. The whole operation is carried out under an atmosphere of nitrogen. Associated apparatus and experimental procedures are included. (L.T.W.)

10389 IGO-AM/W-169
United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.
THE ABSORPTIOMETRIC DETERMINATION OF LEAD IN URINE. Mar. 1958. 6p. $0.27(BIS).

Organic matter is destroyed and the inorganic residue is dissolved in dilute nitric acid. After adjustment of pH to 2.8, any bismuth present is extracted as the dithizonate; the pH is adjusted to 8.0 and lead is extracted as the dithizonate in chloroform and determined absorptiometrically. (auth)

10390 K-1365
Oak Ridge Gaseous Diffusion Plant, Tenn.
MEASUREMENT OF IMPURITY EFFECTS IN THE MASS SPECTROMETER ISOTOPIC ANALYSIS OF URANIUM HEXAFLUORIDE. J. C. Horton. June 24, 1958. 10p. Contract W-7405-26. $0.50(OTS).

Tests to determine the extent of the isotopic analysis errors resulting from ion beam distortion by gaseous impurities in uranium hexafluoride samples were run on several mass spectrometers. Mixtures of uranium hexafluoride with five other gases were compared to pure uranium hexafluoride of identical isotopic composition, noting the bias of the measured ratios of mole ratios from unity. Nitrogen caused a greater bias than the other gases tested; ten per cent nitrogen can cause a bias of more than one per cent in the ratio of pure to impure sample mole ratios. (auth)

10391 K-1369
Oak Ridge Gaseous Diffusion Plant, Tenn.
MEASUREMENT OF THE ISOTOPIC ENRICHMENT OF URANIUM BY A DIRECT COMPARISON MASS

SPECTROMETER METHOD. V. L. Warren and L. A. Smith. June 24, 1958. 18p. Contract W-7405-eng-26. $0.75(OTS).

A direct comparison mass spectrometer method of measuring the separation of uranium isotopes is described. Data are given to show that for separation factors less than 1.06, the accuracy and precision are equivalent to those of the commonly used hexafluoride dilution method. The technique is useful for other separation factor ranges and is particularly adaptable to automatic instruments which should give even better results. (auth)

10392 KAPL-M-VFC-2
Knolls Atomic Power Lab., Schenectady, N. Y.
DETERMINATION OF MERCURY IN SOLIDS FROM S3G/S4G MAIN COOLANT PUMP. V. F. Consalvo. June 11, 1958. 6p. Contract W-31-109-Eng-52. $1.80 (ph OTS); $1.80(mf OTS).

The distillation-amalgamation method for mercury in ores was applied with slight modifications to the determination of mercury in solid material (crud) removed from S3G/S4G coolant pumps. The sample of crud is dried at 50 to 75°C, cooled, weighed, and transferred to a VYCOR crucible. The crucible is covered with a weighed gold foil which is cooled by contact with a beaker of ice. Heat is applied to the crucible, and mercury is volatilized and condensed on the gold foil. The amalgamated gold foil is reweighed to determine the mercury content of the sample. (auth)

10393 LA-2171
Los Alamos Scientific Lab., N. Mex.
DETERMINATION OF IRON IN URANIUM BY THE CARRIER-DISTILLATION METHOD USING COBALT AS AN INTERNAL STANDARD. John B. Ramsay. Aug. 1957. 30p. Contract W-7405-eng-36. $1.00 (OTS).

The spectrographic carrier-distillation method used at Los Alamos to determine impurities in uranium has been modified to include cobalt as an internal standard for the determination of iron. The precision and bias have been evaluated and compared with the original method by a study of synthetic samples ranging in iron content from 25 to 400 ppm. The use of 250 ppm of cobalt as an internal standard gave a coefficient of variation of 9 percent and a bias of plus 6 percent compared to 14 percent and plus 44 percent, respectively, in the absence of cobalt. Analyses of the synthetic samples also showed the internal standard method to be as accurate as a commonly used colorimetric method and less biased than two Oak Ridge spectrochemical methods. In the course of this investigation a comparison was made of the results obtained for various elements as determined by the Oak Ridge carrier-distillation method and two Los Alamos carrier-distillation methods, with and without cobalt. Analyses of variance were used to detect significant differences when analyzing laboratory exchange samples for aluminum, silicon, and manganese. In the presence of 250 ppm cobalt the results for manganese were approximately 40 percent lower than in the absence of cobalt. No significant difference among the three methods was found for silicon but it was found that the results for aluminum obtained at Oak Ridge were significantly lower than for either Los Alamos method. (auth)

10394 NP-6730
Illinois. Univ., Urbana.
COULOMETRIC TITRATIONS IN MOLTEN LITHIUM CHLORIDE–POTASSIUM CHLORIDE EUTECTIC. Technical Report No. 4. H. A. Laitinem and B. B. Bhatia. May 1, 1958. 12p. Project No. 1486. Contract DA-11-022-ORD-1987.

Electrolytically generated iron (III) was used as an oxidant in coulometric titrations in molten lithium chloride–potassium chloride at 450°C to titrate chromium (II) to chromium (III) and vanadium (II) to vanadium (III). The potentiometric, amperometric with one electrode, and the dead-stop methods of end point detection are compared. Apparatus and procedures are described, and various schemes are evaluated. (J.R.D.)

10395 TID-7015(Sect. 1)
Oak Ridge National Lab., Tenn.
ORNL MASTER ANALYTICAL MANUAL. SECTION 1. IONIC METHODS. TISE issuance date Apr. 1958. 1600p. $9.00(OTS).

Issued in loose-leaf form to facilitate periodic revisions.

Procedures are given for ionic, radiochemical, spectrographic and nuclear analysis for a number of elements and compounds. (W.L.H.)

10396 TID-7015(Secs. 3 and 5)
Oak Ridge National Lab., Tenn.
ORNL MASTER ANALYTICAL MANUAL. SECTION 3. SPECTROGRAPHIC METHODS. SECTION 5. NUCLEAR ANALYSES METHODS. TISE Issuance Date Nov. 1957. 157p. $4.50(OTS).

Procedures are given for the calibration of photographic emulsions for spectrochemical analysis. A spectrographic method is presented for the determination of the major and minor constituents of rare-earth mixtures in test portions that contain not more than 10 μg of rare earths. The windowless proportional β counter described in this method is used for the measurement of β activity of single radionuclides. The scintillation spectrometer described is used for both the qualitative and the quantitative determination of γ rays emitted by radioactive nuclides. The types of neutron reactions that are usually employed in neutron activation analysis are briefly described. The apparatus used for radiochemical determinations is listed. (W.L.H.)

10397 UWFL-51
Washington. Univ., Seattle. Applied Fisheries Lab.
THE OCCURRENCE AND DISTRIBUTION OF RADIOACTIVE NON-FISSION PRODUCTS IN PLANTS AND ANIMALS OF THE PACIFIC PROVING GROUND. Frank G. Lowman, Ralph F. Palumbo, and Dorothy J. South. June 12, 1957. 67p. Contract AT(45-1)-540.

Radiochemical separations were made on selected samples of biological materials from the Pacific Proving Ground. The isotopes in the separated fractions were identified by their half lives, maximum beta energies, and gamma energies. In addition to radioactive fission products, the non-fission radioisotopes, Mn^{54}, Fe^{55}, Fe^{59}, Co^{57}, Co^{58}, Co^{60}, and Zn^{65}, were identified in some samples. The latter isotopes accounted for almost all of the radioactivity in the zoological samples of marine origin. (auth)

10398 WAPD-CTA(GLA)-203
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF NITROGEN IN NIOBIUM. G. W. Goward and E. F. Tretow. Apr. 24, 1956. 5p. $1.80(ph OTS); $1.80(mf OTS).

A method is presented for the spectrophotometric determination of nitrogen in niobium in the range of 5 to 120 parts per million of nitrogen in a one gram sample. Nitrogen contents in excess of 120 parts per million are determined by aliquoting the sample solution prior to distillation. (W.L.H.)

10399 WAPD-CTA(GLA)-471
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
TENTATIVE METHOD FOR THE DETERMINATION OF NIOBIUM IN HIGH PURITY NIOBIUM METAL. R. O. Backer, G. W. Goward, and V. R. Wiederkehr. Nov. 12, 1957. 6p. $1.80(ph OTS); $1.80(mf OTS).

A method is described for the determination of the total Nb in Nb metal. The precision of the method is ~ ± 0.2% of the amount present at the 95% confidence level. (W.L.H.)

10400 WAPD-CTA(GLA)-500
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF MANGANESE AS AN IMPURITY IN NIOBIUM. D. V. Reed and G. W. Goward. Dec. 31, 1957. 4p. $1.80(ph OTS); $1.80(mf OTS).

A method for the spectrophotometric determination of Mn in Nb in the range of 10 to 200 parts per million on the basis of a one gram sample is presented. (W.L.H.)

10401 WAPD-CTA(GLA)-501
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF MOLYBDENUM AS AN IMPURITY IN NIOBIUM. D. V. Reed. Dec. 31, 1957. 5p. $1.80(ph OTS); $1.80(mf OTS).

A method for the spectrophotometric determination of impurity Mo in Nb over the range of 10 to 1000 parts per million on a one gram sample basis is presented. Milligram amounts of W, V, and Cu do not interfere. (W.L.H.)

10402 WAPD-CTA(GLA)-506
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF COPPER AS AN IMPURITY IN NIOBIUM. D. V. Reed. Jan. 7, 1958. 5p. $1.80(ph OTS); $1.80(mf OTS).

A method is presented for the spectrophotometric determination of Cu in Nb in the range of 10 to 2000 parts per million on a one gram sample basis. (W.L.H.)

10403 WAPD-CTA(GLA)-511
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF IRON AS AN IMPURITY IN NIOBIUM. E. N. Brown and D. V. Reed. Jan. 16, 1958. 5p. $1.80(ph OTS); $1.80(mf OTS).

A method for the spectrophotometric determination of impurity Fe in Nb in the range of 25 to 1000 parts per million on a one gram sample basis is presented. (W.L.H.)

10404 WAPD-CTA(GLA)-542
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF TANTALUM IN NIOBIUM. Mary Louise Theodore. Feb. 27, 1958. 7p. $1.80(ph OTS); $1.80(mf OTS).

The metal is dissolved in hydrofluoric and nitric acids. Hydrochloric acid is added and the tantalum is extracted with methyl isobutyl ketone. The tantalum is removed from the ketone layer by precipitation with ammonium hydroxide. The tantalum precipitate is dissolved in hydrofluoric and hydrochloric acids, re-extracted from a hydrochloric acid medium and converted to the hydroxide. The hydroxide is fused with potassium pyrosulfate, and the tantalum determined spectrophotometrically using the tantalum pyrogallol system. Photometric measurement is made at a wave length of 355 μ in 5 cm cells. (auth)

10405 WAPD-PWR-CP-3092
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
PRELIMINARY REPORT ON A NEW METHOD OF ANALYZING FOR OXYGEN DISSOLVED IN WATER. J. M. Wright and P. E. McGrath. [May 1957]. 13p. $3.30(ph OTS); $2.40(mf OTS).

The method is based on the rapid reaction of Tl metal with dissolved O_2. Oxide layer formation is no deterrent because the thallous oxide formed dissolves as TlOH, a strong base. Thus the increase in conductance of a deionized, O_2-bearing solution on passing through a Tl bed is a measure of O_2 concentration. The method is rapid, specific, precise, and useful over a wide range of concentration. It is safe, requires only simple inexpensive small-scale equipment, partially available commercially. The operating cost is low, and the method is adaptable to high pressure and does not require high water temperature. (T.R.H.)

10406 AEC-tr-3270
APPLICATION OF THE RING FURNACE IN SPOT COLORIMETRY. Herbert Weiss. Translated by Lydia Venters (Argonne National Lab.) from Mikrochim. Acta, 785-94(1954). 12p.

The ring furnace method was employed for spot colorimetric analyses. Several rings with different numbers of sample drops were prepared and compared with standard rings. An exact estimate is not necessary. An approximate coordination of the test rings to the standard rings is adequate for obtaining usable results. Examples described include determination of: iron with potassium ferrocyanide, nickel with dimethylglyoxime, cobalt with α-nitroso β-naphthol, copper with hydrogen sulfide water and conversion of the copper sulfide into its equivalent of silver sulfide. In most cases, the removal of interfering ions can be accomplished on the paper itself. (auth)

10407 AEC-tr-3271
THE SEPARATION PROCEDURE IN A SINGLE DROP. Herbert Weiss. Translated by Lydia Venters (Argonne National Lab.) from Mikrochim. Acta 140-7(1954). 10p.

A new simple method is given for separating ions or groups of ions in a single drop. Two pieces of equipment have been developed for this purpose. One serves for simple precipitations on filter paper with gaseous reagents. An apparatus, designated as a ring furnace, is designed to wash the soluble materials from a spot and to concentrate them in a sharply bounded circular zone, where they can be detected. The usefulness of the procedure is demonstrated by typical examples. (auth)

10408
THE ANALYTICAL DETERMINATION OF RADIOCESIUM IN FORM OF A TUNGSTATE-PHOSPHOR. Vikt. I. Spitzyn and N. B. Mikheyev. Atomnaya Energiya 3, 255-6(1957).

A gravimetric determination for radiocesium is described. The presence of sodium salts, rare earths, magnesium, aluminum, and potassium do not interfere. (J.S.R.)

10409
ANALYTICAL STUDIES OF BORON. VI. DETERMINATION OF BORON USING ION EXCHANGE RESIN. Satoru Muto (Gunma Univ., Kiriu). Bull. Chem. Soc. Japan 30, 881-5(1957) Nov.

When boric acid is treated with a cation exchange resin, it can be separated quantitatively from cations which co-exist with it. Such a separation procedure was applied to the determination of boron in steel, silicon, and silicate rocks. For the determination of boron, a sample solution was passed through a cation exchange resin column and the effluent titrated with an alkaline solution. (auth)

10410
THE EVAPORATION METHOD AND ITS USE FOR THE DETERMINATION OF BORON AND OTHER IMPURITIES

IN URANIUM. S. L. Mandelshtam, N. N. Semenov, and Z. M. Turovtseva (Lebedev Inst. of Physics, Academy of Sciences, USSR, Moscow). J. Anal. Chem. U.S.S.R. (English Translation) 11, 7-16(1956) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 10, as abstract No. 8055.

10411

SPECTROGRAPHIC ANALYSIS BY THE EVAPORATION METHOD. I. PRINCIPLES OF THE METHOD OF EVAPORATION IMPURITIES IN A VACUUM, AND SOME OF ITS APPLICATIONS. A. N. Zaidel, N. I. Kaliteevskii, L. V. Lipis, M. P. Chaika, and Yu. I. Belyaev (Zhdanov State Univ., Leningrad and Vernadsky Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR, Moscow). J. Anal. Chem. U.S.S.R. (English Translation) 11, 17-24(1956) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 10, as abstract No. 8056.

10412

MAINTENANCE OF TEMPERATURE CONDITIONS DURING PHOTO-COLORIMETRIC DETERMINATION OF SODIUM BY MEANS OF $NaNi(UO_2)_3(CH_3COO)_9 \cdot 6H_2O$. A. I. Krupkin and G. A. Lorina. J. Anal. Chem. U.S.S.R. (English Translation) 11, 25-7(1956) Jan.-Feb.

The effect of temperature on the formation of sodium nickel uranyl acetates during the colorimetric determination of sodium was studied. For the experimental study, the temperature of all solutions (test material, precipitant, and alcohol) were kept at 20 ± 1° when they were poured together. The temperature of the thermostat in which test samples were kept for 16 to 20 hours could be adjusted to operate at 10, 20, 30, 40, and 50 ± 1°. The results indicated that thermostating test samples at 30° and leaving then for 16 to 20 hours resulted in the complete precipitation of the sodium salts. Lowering the temperature leads to precipitation of the ternary salt from the precipitant. At higher temperatures the amount of precipitated salt decreases rapidly. (J.S.R.)

10413

THE BENZOATE METHOD OF ALUMINUM DETERMINATION. A. I. Ponomarev and A. Ya. Sheskolskaya (A. A. Baikov Inst. of Metallurgy, Academy of Sciences, USSR, Moscow). J. Anal. Chem. U.S.S.R. (English Translation) 11, 101-4(1956) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 10, as abstract No. 7586.

10414

DETECTION OF BERYLLIUM WHEN NO PRECIOUS METAL VESSELS ARE AVAILABLE. E. P. Ozhigov and T. I. Vedernikova (Far East Sect. of the USSR Academy of Sciences). J. Anal. Chem. U.S.S.R. (English Translation) 11, 111-13(1956) Jan.-Feb.

This paper was previously abstracted from the original language and appears in NSA, Vol. 10, as abstract No. 7502.

10415

A MICROFLOTATION METHOD OF ANALYZING HEAVY WATER. I. P. Gragerov (L. V. Pisarzhevsky Inst. of Physical Chemistry). J. Anal. Chem. U.S.S.R. (English Translation) 11, 271-5(1956) May-June.

This paper was previously abstracted from the original language and appears in NSA, Vol. 10, as abstract No. 10032.

10416

SYSTEMATIC AND RANDOM ERRORS IN CHEMICAL ANALYSIS. V. V. Nalimov. J. Anal. Chem. U.S.S.R. (English Translation) 11, 351-9(1956) May-June.

Chemical analysis is a complex measuring process, which differs in principle from elementary measuring processes which are dealt with in metrology. In chemical analysis, in addition to the random error of reproducibility, there is one further random error, which is determined by the characteristics of the chemical (and sometimes, phase) composition of test samples. The distribution law of this error is considered. Various methods of evaluating the magnitude of this error are critically considered; conditions under which standards can be used for establishing reliability limits are established. (auth)

10417

A DIRECT-PLATING METHOD FOR THE PRECISE ASSAY OF CARBON-14 IN SMALL LIQUID SAMPLES. C. C. McCready (Univ. of Oxford). Nature 181, 1406 (1958) May 17.

Incorporation of liquid samples of compounds containing carbon-14 in a layer of gel produces counting samples which will dry to an even film thus ensuring reproducible self-absorption and counter geometry. The procedure is described in detail. (C.H.)

10418

ERIOCHROMEBLACK T AND CARMIN ACID AS INDICATORS IN THE COMPLEXOMETRIC DETERMINATION OF ZIRCONIUM. V. G. Goryushina and Ye. V. Romanova. Zavodskaya Lab. 23, 781-4(1957).

Carmin acid and Eriochromeblack T can be used as indicators in the titration of bivalent zirconium by Complexone III. The presence of other metals or sulfates does not interfere with the determination. (J.S.R.)

Atomic Weights and Periodic Systems

10419

URANIDES AND THEIR PHYSICAL HOMOLOGY. C. G. Bedreag. An. Stiint. Univ. Lasi. 1, Section I, No. 1-2, 231-42(1955). (Translated from Referat. Zhur. Khim. No. 9, Abstract No. 29511.)

Physical homology has been ascertained for Th, U, and the other actinides on the basis of investigation of their electronic structure.

10420

ELEMENT 102. Z. G. Atomnaya Energiya 3, 265(1957).

Element 102 nobelium was obtained from the reaction $Cm^{244} + C^{13}$ at Stockholm. The new isotope has the mass number 251 to 253, disintegrates with a half life of 10 min, and emits α particles with an energy of 8.5 Mev. (TCO)

Crystallography and Crystal Structure

10421 UCRL-8225

California. Univ., Berkeley. Radiation Lab.

THE CRYSTAL STRUCTURE OF VANADYL BIS-ACETYLACETONATE (thesis). Richard Patrick Dodge. Mar. 31, 1958. 27p. Contract W-7405-eng-48. $0.75(OTS).

The crystal structure of the chelate vanadyl bis-acetylacetonate has been determined by x-ray diffraction. The compound is not a polymer in the solid but forms separate molecules, and there is no intermolecular bonding other than the usual Van der Waals type.

The main feature of interest in the result is the geometrical arrangement of oxygen atoms about the central vanadium atom. The ligand oxygens form a square plane perpendicular to the vanadyl ion; however, the vanadium atom is not in this plane but slightly above it. The structure determination was carried out by Fourier methods and refinement of the parameters was done by the least-squares method. Fourier summations were computed on the IBM 701 calculator, and the program used for these calculations is briefly described. (auth)

10422

INFRA-RED AND CRYSTALLOGRAPHIC INVESTIGATION OF THE TlCN–KCN–H_2O SYSTEM; THE LACK OF Tl(I)-CYANIDE COMPLEXES. R. A. Penneman and E. Staritzky (Los Alamos Scientific Lab., N. Mex.). J. Inorg. & Nuclear Chem. 6, 112-18(1958) Apr.

Infra-red, x-ray, and optical studies of solid phases obtained in the system TlCN–KCN–H_2O showed that no compound was formed between KCN and TlCN. Failure to find the compound $KTl(CN)_2$ is contrary to earlier work. Solid solutions between TlCN + KCN were investigated in which Tl^+ substitutes for K^+ in the KCN structure up to a limit of ca. 37 mole % Tl^+. A new value for the cell dimension of TlCN was found, a_0 = 3.994 ± 0.001 A. Aqueous thallium(I) cyanide solutions containing a large excess of potassium cyanide (KCN/TlCN ratios as high as 100/1) gave no infra-red absorption peak ascribed to the $Tl(CN)_2^-$ anion. From the lack of effect of Tl^+ ion on the $Ag(CN)_2^- + CN^- \rightleftharpoons Ag(CN)_3^{-2}$ equilibrium, it is shown that the value of the TlCN association constant, $TlCN/(Tl^+)(CN^-)$, is less than unity. Thus the thallium(I) ion has a smaller tendency to co-ordinate with cyanide ion than it does with chloride ion. (auth)

Deuterium and Deuterium Compounds

10423 AERE-GP/R-2479

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE PREPARATION OF DEUTEROSULPHURIC ACID AND DEUTEROCHLORIC ACID; THE DENSITY OF D_2SO_4 SOLUTION. J. H. Freeman and C. E. C. Richards. Feb. 1958. 5p. $0.32(BIS).

Laboratory scale preparations are described of deuterosulfuric acid by the electrolysis of copper sulfate in heavy water, and the reaction of sulfuryl chloride with D_2O. A method for the preparation of deuterochloric acid by the reaction of thionyl chloride with D_2O is also given. A curve showing the density of D_2SO_4 in the range 0 to 30N is included. (auth)

10424

REACTION OF DEUTERIUM ATOMS WITH ETHANE—MECHANISM OF METHANE EXCHANGE. R. Berisford and D. J. Le Roy (Univ. of Toronto, Ont., Can.). Can. J. Chem. 36, 983-9(1958) June.

The reaction of deuterium atoms with ethane has been studied at 25°C by the method of mercury ($^3P_1$) photosensitization. Methane formation takes place by the addition of deuterium atoms to methyl radicals in the presence of a third body. From the dependence of methane exchange on third-body concentration the lifetime of the excited methane molecule is estimated to be of the order of 10^{-9} sec. The lifetime of the excited ethane molecule formed by the addition of a deuterium atom to an ethyl radical is estimated to be considerably less than 10^{-9} sec. (auth)

10425

THE MASS SPECTRA OF THREE DEUTERATED BUTANOLS. W. H. McFadden, M. Lounsbury, and A. L. Wahrhaftig (Atomic Energy of Canada, Ltd., Chalk River, Ont., Can. and Univ. of Utah, Salt Lake City). Can. J. Chem. 36, 990-8(1958) June.

The mass spectra of 1,1-dideutero-1-butanol, 1,1,1,3,3-pentadeutero-2-butanol, and 1,1,1,2,3,3-hexadeutero-2-butanol have been obtained using 70-volt ionizing electrons. Comparison of the cracking patterns of the deuterated butanols with those of the undeuterated compounds confirms certain known features of the mass spectra of alcohols and reveals further information regarding the formation of several rearrangement ions. The strong tendency for alcohols to break at bonds beta to the hydroxyl group has been attributed to charge localization on the oxygen and this feature is used to explain the formation of many of the rearrangement ions. It is postulated that a hydrogen atom may be transferred to the electron-deficient oxygen and that the resulting structure distributes its excess energy and charge to give the activated complexes leading to the observed ions. (auth)

10426

DEUTERIUM ISOTOPIC ANALYSIS METHODS. B. Brigoli (CISE, Milan). Energia nucleare (Milan) 5, 317-25(1958) May. (In Italian)

The paper deals with the optical method and other analytical methods employed in deuterium isotopic analysis, such as nuclear magnetic resonance and thermal conductivity measurement. (auth)

Fluorine and Fluorine Compounds

10427 AEC-tr-3192

THERMAL AND X-RAY ANALYSIS OF THE KF–BeF_2 SYSTEM. M. P. Borzenkova, A. V. Novoselova, Yu. P. Simanov, V. I. Chernykh, and E. I. Yarembash. Translated from Zhur. Neorg. Khim. 1, 2071-82(1956). 12p.

From the thermographic and x-ray phase analysis of the KF–BeF_2 system, the formation in the system of the following fluoberyllates was established: K_3BeF_5; K_2BeF_4; $KBeF_5$; KBe_2F_5. Potassium fluoberyllate of the K_3BeF_5 composition is formed at 740 ± 5° according to the peritectic reaction:

$$K_2BeF_4 + \text{melt (KF, } BeF_2) \overset{740°}{\rightleftharpoons} K_3BeF_5.$$

Potassium fluoberyllate K_2BeF_4 melts without decomposition at 791 ± 5°. The existence of two modifications was detected. The transformation temperature is 695 ± 5°. Potassium fluoberyllate $KBeF_3$ melts at 406 ± 5°. Potassium fluoberyllate of composition KBe_2F_5 decomposes at 275 ± 5°, without reaching its melting temperature. Pure BeF_2 upon cooling solidifies in the form of glass. The initial melting temperature of crystalline BeF_2 is 545 ± 5°, and the melt becomes transparent at about 740 to 780°. For the $KBeF_3$ compound by identifying the x-ray grams of the powder, the actual parameters of the rhombic lattice were determined: a = 5.464 ± 0.001 kX; b = 4.505 ± 0.001 kX; c = 12.05_8 ± 0.005 kX with four formulated units in it. (auth)

10428

THERMAL AND X-RAY PHASE ANALYSIS OF THE CsF–BeF_2 SYSTEM AND ITS INTERRELATIONS WITH MeF–BeF_2 SYSTEMS. O. N. Breusov, A. V. Novoselova, and Yu. P. Simanov (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 118, 935-7(1958) Feb. 11. (In Russian)

The system $Me^{+}F-BeF_2$ is considered as the weakened fluoride model for the $Me^{2+}O-SiO_2$ system where Me^{+} is Li, Na, K, or Rb. A differential-thermal and x-ray analysis was made of $CsF-BeF_2$ systems to determine the stability variations in various fluoberylates. The highest stability was found in the complexes of the Me_2BeF_4 type. The stability of Me_2BeF_4 increases from Li to Rb and slightly decreases from Rb to Cs. The phase diagram of $CsF-BeF_2$ system is included. (R.V.J.)

10429

DISLOCATION ETCH PIT FORMATION IN LITHIUM FLUORIDE. J. J. Gilman, W. G. Johnston, and G. W. Sears (General Electric Research Lab., Schenectady, N. Y.). J. Appl. Phys. 29, 747-54(1958) May.

Dislocation etch pits can be formed on LiF by a dilute aqueous solution of FeF_3. In this report the etch pit formation is described in detail, and the mechanism for pit formation is discussed. The nature of the etch pits depends on the character of the dislocation, and on the exact composition of the etchant. Edge dislocations and screw dislocations etch slightly differently; the former produce deeper pits. The etching is inhibited by some segregated impurities at dislocations, therefore aged dislocations and fresh dislocations etch much differently. Etch pit formation is probably due to the preferential nucleation of unit pits one molecule deep at a dislocation, and the movement of the monomolecular steps across the surface. The relative rates of these two processes determine the shape of the etch pits. The nucleation rate for unit pits depends upon the dislocation energy, hence upon the character of the dislocation and the impurity content as suggested by Cabrera. The nucleation rate is faster at edge dislocations, because of their higher energy. The nucleate rate is low at dislocations with segregated impurities, because the impurities lower the dislocation energy. The ferric ion is adsorbed on the surface and inhibits the motion of steps, so that steeper, more visible pits are produced as the iron content is increased. (auth)

10430

THERMAL CONDUCTIVITY OF SODIUM FLUORIDE CRYSTAL AT LOW TEMPERATURES. Anna Foner Cohen (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 29, 870(1958) May.

The conductivity vs. temperature for a sodium fluoride specimen is graphed. It appears that the magnitude of the thermal conductivity vs. temperature at temperatures above the maximum of the specimen is considerably lower than that expected theoretically. However, the exponential dependence of conductivity at temperatures above the maximum is observed. (A.C.)

10431

VIBRATIONAL INTENSITIES. IX. C_2F_6: EXTENSION AND REVISION. I. M. Mills, W. B. Person, J. R. Scherer, and Bryce Crawford, Jr. (Univ. of Minnesota, Minneapolis). J. Chem. Phys. 28, 851-3(1958) May.

The intensity of the low fundamental of C_2F_6 at 219 cm^{-1} was measured using a CsI prism. This completed earlier studies on the other fundamentals, and permits extension and revision of the interpretation. Effective bond moments are compared with those of other fluorocarbons. (auth)

10432

MASS SPECTRA OF HALOGEN FLUORIDES. A. P. Irsa and L. Friedman (Brookhaven National Lab., Upton, N. Y.). J. Inorg. & Nuclear Chem. 6, 77-90 (1958) Apr.

Appearance potentials and positive-ion mass spectra were determined for IF_5, BrF_5, BrF_3 and ClF_3. A negative-ion study was made on BrF_3. The gas samples were subjected to rate of effusion studies in the mass spectrometer sample system and shown to contain diatomic halogen and halogen fluoride impurities. Halogen oxyfluorides were detected in BrF_5, BrF_3 and ClF_3 samples and reaction between O_2 and BrF_5 was observed on mixing. Upper limits for ionization potentials were obtained for IF_5, IF, ICl, IBr, BrF_3, BrF, BrCl, ClF_3 and ClF directly from appearance potentials. Ionization potentials for the radicals BrF_2 and ClF_2 were deduced using supplementary thermochemical data. Ionization potentials of diatomic interhalogens with the exception of BrCl give bond dissociation energies for interhalogen molecule ions approximately equal to corresponding values for neutral molecules. (auth)

Graphite

10433 LAMS-2211

Los Alamos Scientific Lab., N. Mex.

VINYL COATING OF GRAPHITE PLATES FOR ULTRASONIC INSPECTION. James S. Church, John H. Bell, Jr., John K. Donahoe, Roscoe A. Faussone, Gerald B. Rogers, and Jerome T. Rowen. Mar. 25, 1958. 46p. Contract W-7405-eng-36. Charge $1.25(OTS).

A process has been developed for application of a thin, adherent vinyl plastic coating to graphite plates to prevent absorption of "coupling fluids" used in ultrasonic inspection. The plates are preheated and dipped mechanically in a fluid plastisol, and the resulting coating is fused in an infra-red heater. No significant attenuation of ultrasonic impulse results from presence of the coating. After inspection, the vinyl sheath may be easily stripped from the plate. (auth)

10434 NAA-SR-2293

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SOME PHYSICAL PROPERTIES OF HIGH DENSITY GRAPHITES. A. E. Miller. May 15, 1958. 26p. Contract AT-11-1-GEN-8. $0.75(OTS).

The short-time tensile strength of a number of grades of special high-density graphite was measured at room temperature and at 2000°C. Measurements of density and fluid permeability were made at room temperature. Included for comparison are the values of these properties obtained on one of the better commercially available graphites before and after a furfural polymerization treatment. The characteristic increase in strength with temperature was exhibited by all grades and, in general, the high-density graphites were stronger and exhibited lower permeability than the commercial grade. Furfural treatment of the commercial grade significantly increased its strength so that it exceeded the strength of the high-density grades. In addition, this treatment increased the density and improved the permeability of this grade. (auth)

10435 NP-6767

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

GRAPHITE TECHNOLOGY. Progress Report No. 7 for the period April 1, to June 1, 1958. S. W. Bradstreet. 23p. Project No. G-033. Contract AF33(616)-5185.

During the period from April 1 through May 31, 1958, experimental work centered about the preparation of specimens for graphitization. Sufficient standards were prepared to obtain preliminary information on the graphitic properties of: the pitch-bonded calcined

petroleum coke standard, a pitch-bonded coke-thermax mixture, the standard mix containing added metal carbide, and a mix bonded with furfuryl alcohol. In the preparation of these, it was found that the packing characteristics of the No. 90 calcined petroleum coke are more strongly influenced by the proportion of added furnace carbon than was previously supposed. This influence is explicable from packing theory. It was experimentally determined, and confirmed by communications from other researchers, that the furfuryl alcohol polymer is highly sensitive to oxidation during carbonization, so that a swept inert gas atmosphere must be substituted for ordinary packed sagger systems when this binder is used. It is recommended that this program be renewed, to permit standardization of the mixing, forming, and baking techniques of furfuryl alcohol-bonded mixes as completely as has been done for pitch-bonded ones; and to develop graphite bodies of high structural strength on a sound basis of structural considerations. (auth)

10436

GRAPHITE IN REACTOR CONSTRUCTION. V. V. Goncharov. Atomnaya Energiya 3, 398-408(1957). (In Russian)

A survey is presented of the use of graphite in reactor construction. The following topics are discussed: properties of a moderator, physical and chemical properties of graphite and graphite-containing materials, technology of the production of graphite electrodes and blocks, graphite in reactors, and the effects of radiation on the properties of graphite. Soviet production of graphite and the quality of reactor graphite are briefly reviewed. (J.S.R.)

10437

CHARACTERISTICS OF FREE ELECTRONS IN GRAPHITE FROM A STUDY OF ITS MAGNETIC AND OTHER PROPERTIES. Ajit Kumar Dutta (Indian Assn. for the Cultivation of Science, Calcutta). Physica 24, 343-6 (1958) May.

The various parameters of the free electron gas in graphite were deduced from the observation of its magnetic and thermal properties without making assumptions regarding the zone picture for these electrons. The results obtained are discussed in relation to parameters obtained from the De Haas-Van Alphen effect. The significance of the values of the parameters deduced are also indicated. (auth)

Laboratories and Equipment

10438 CF-58-5-32

Oak Ridge National Lab., Tenn.

AN ENGINEERING EVALUATION OF A MAGNETIC FILTER AS A MEANS OF REMOTE CONTROL FILTRATION. R. J. McNamee and L. B. Shappert. [May 1958]. 22p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

For presentation at the Annual Meeting of the American Nuclear Society in Los Angeles, California; June 2-5, 1958.

An evaluation was made of a remote control method of filtration, using a ferromagnetic powder suspended in a magnetic field as the filtering media. A filter of this kind would have the advantage of being able to form and discharge the filter bed (and resulting cake) by control of the current to the electromagnet providing the magnetic field. Studies on a 3-inch diameter filter column showed the principle to be feasible, using ferrosilicon as the filtering media. Data necessary for scale-up and design were obtained, and their use in such calculations is discussed. (auth)

10439 NARF-58-19T

Convair, Fort Worth, Tex.

REMOTE INSPECTION OF AIRCRAFT WITH TELEVISION. W. A. Baird. May 12, 1958. 51p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-209).

A preliminary experiment was performed in the use of closed-circuit black and white television to inspect aircraft. Television equipment was used to evaluate the effect of lighting, camera position, and lenses on the inspection problem. An industrial closed circuit television system was set up at a B-47 airplane. The time required and the accuracies obtained were compared between normal (direct visual) inspections of certain items and remote inspections made with television equipment. The effectiveness of television inspection was studied in a series of experimental set-ups. For each set-up, the interrelationships of the factors which influence picture quality were studied. A detailed analysis is presented of optical phenomena and television equipment characteristics. Subjects treated include depth of field, resolution, video bandwidth, lens systems, and lighting. The experiment shows that remote inspection of aircraft with television is feasible. Results indicate that off-the-shelf type television components can be obtained which are satisfactory for this application. Only such items as the lighting equipment and the camera boom and dolly will have to be of special design. (auth)

10440

STORAGE BINS FOR CONTAINERS WITH MATERIALS EMITTING γ-RAYS. V. Yemel'yanov. Atomnaya Energiya 3, 565(1957).

A storage bin was constructed for containers to store materials emitting γ rays, especially Co^{60} and Cs^{137}, with a total activity of about 100 mg-equiv. of radium. The storage bin is made of iron plate and consists of two sections. The 40-cm-high lower section, the storage space proper, is equipped with a rotary device. The 60-cm-high upper section is filled with concrete for radiation protection. A 10-cm diameter opening in the concrete layer, makes possible the placing of containers upon the rotating iron plate. (TCO)

10441

A SMALL "HOT" LABORATORY (FOR PREPARATIONS UP TO 100 c). L. Suvorov. Atomnaya Energiya 4, 304-5(1958) Mar. (In Russian)

The construction and operation are described. (R.V.J.)

10442

SURFACE PHENOMENA AT ULTRA-HIGH VACUUM. I. THE PRODUCTION AND MEASUREMENT OF ULTRA-HIGH VACUUM BY ALPERT'S METHOD. Koji Kawasaki and Toshio Sugita. Denki Shikensho Ihô 22, 241-51(1958) Apr. (In Japanese)

An apparatus constructed for the production and measurement of ultra-high vacuum according to Alpert's method is described. Vacuums up to 10^{-10} mm Hg are obtained. The purpose of the device is to study the properties of clean surfaces, which are of much interest to investigators of surface phenomena of solids, especially metals and semiconductors. (tr-auth)

10443

ELECTROLYSIS OF SODIUM INTO A REACTION VESSEL. William L. Jolly (Univ. of California, Livermore and Berkeley). J. Phys. Chem. 62, 629-30(1958) May.

A technique for introduction of small measured amounts of sodium metal into an evacuated glass reaction vessel by electrolysis is described. (J.R.D.)

10444

THE ACCURATE MEASUREMENT OF TEMPERATURE. J. A. Hall (National Physical Lab., Teddington, Middlesex, Eng.). Research (London) 11, 147-51(1958) Apr.

Methods of measuring temperatures accurately using the platinum resistance thermometer, mercury thermometer, thermocouple, and the disappearing-filament pyrometer are described. (W.L.H.)

10445

THE HOMOGENEOUS REACTOR TEST CHEMICAL PROCESSING PLANT. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 7, Session 37. W. D. Burch (Oak Ridge National Lab., Tenn.). New York, American Institute of Chemical Engineers, 1958. 15p.

A processing plant has been constructed in a cell adjacent to the Homogeneous Reactor Test to continuously purify the enriched uranyl sulfate fuel solution of this reactor. Insoluble corrosion and fission products are removed by centrifugal separation in a hydraulic cyclone operated at reactor temperature and pressure. These insolubles comprise all corrosion products except nickel and approximately 70 per cent of the fission products. A weekly batch letdown of the recovered solids with 2 per cent of the fuel solution provides a purge of soluble fission and corrosion products. Samples of the products removed after complete dissolution in a light water sulfuric acid system, provide plant performance data. The solution is stored for radioactive decay in vessels within the cell and ultimately transferred to another site for recovery of enriched uranium. Over 1000 hours of nonradioactive operation of the hydroclone system have demonstrated operability and established performance characteristics of the system. (auth)

10446

AUXILIARY EQUIPMENT FOR RADIOCHEMICAL PROCESSING. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 26, Session 34. William E. Unger (Union Carbide Nuclear Co., Oak Ridge, Tenn.). New York, American Institute of Chemical Engineers, 1958. 69p.

Most radiochemical processing equipment is basically similar to its industrial counterparts. The principal distinguishing differences are in details of design, the quality standards to which radiochemical equipment is fabricated, and, most conspicuously, the massive shielding that is peculiar to radiochemical process equipment. Examples are described of both specially designed items and the adaptation of commercial equipment, including valves, filters, centrifuges, samplers, and carrier-chargers. (auth)

Molecular Structure

10447

HYDROGEN PEROXIDE AND ITS ANALOGUES. VIII. EXCESS FUNCTIONS FOR THE BINARY SYSTEMS $H_2O-H_2O_2$ AND $D_2O-D_2O_2$. Paul A. Giguère, Osvald Knop, and Michael Falk (Laval Univ., Quebec, Can.). Can. J. Chem. 36, 883-95(1958) June.

Recent volumetric and calorimetric data have been used to calculate the excess functions for mixtures of water and hydrogen peroxide over the entire concentration range. The results are compared with those for the corresponding deuterium compounds. The existing calorimetric and vapor-pressure measurements are not comprehensive nor accurate enough to support discussion of the finer details of the excess quantities. A maximum in the excess-volume curves, presumably related to the formation of the compound $H_2O_2 \cdot 2H_2O$, persists in the liquid mixtures over an appreciable temperature range above the melting point of that compound. A possible crystal structure is proposed for the latter. New density determinations were carried out on mixtures of heavy water and deuterium peroxide at 0 and 20°C and the effect of deuterium peroxide on the temperature of maximum density of heavy water was measured and compared with that of deuterated alcohols. It is concluded that the structure of liquid water is easily penetrated by hydrogen peroxide molecules. (auth)

Radiation Chemistry

Refer also to abstract 11039.

10448 IGRL-T/D-60

PHOTOCHEMICAL STUDIES IN THE SCHUMANN ULTRA-VIOLET. NOS. 3 AND 4. W. Groth. Translated by R. S. Forsyth from Z. physik. Chem. 37B, 307-22(1937). 13p.

The further development of the Harteck xenon lamp with the aid of a fluorspar vacuum spectrograph is described, and the distribution of the total intensity of the light source in the extreme ultra-violet between the two resonance wavelengths of xenon, at 1470 Å and 1295 Å, is determined. Also, the quantum yields are measured of ammonia and carbon dioxide decomposition and the formation of ozone from pure oxygen and from oxygen-nitrogen and oxygen–argon mixtures. Flowing mixtures of carbon monoxide and small percentages of oxygen were irradiated at atmospheric pressure with the light of the xenon lamp (1470 and 1295 Å), and the dependence of the reaction products, ozone and carbon dioxide, on the oxygen partial pressure was measured. A collision yield of $^1/_{40}$ was obtained for the formation of CO_2 from CO and O atoms in three-body collisions. In addition, mixtures of CO and H were irradiated by means of the same light source. In this case, the CO molecule acts as a sensitizer of the formation of aldehyde from CO and H atoms. On irradiation, mixtures of CO and methane also gave formaldehyde or glyoxal. (auth)

10449

SOVIET RADIOCHEMISTRY. A. N. Murin. Atomnaya Energiya 3, 459-64(1957). (In Russian)

Soviet achievements in the field of radiation chemistry are chronologically listed. The most important developments were concerned with the radioelements in the physical-chemical system, chemistry of the radioelements, and chemical methods for the investigation of nuclear reactions. (J.S.R.)

10450

CHEMICAL EFFECTS OF THE $Br^{81}(\gamma,\alpha)As^{77}$ REACTION IN BROMIDES. D. H. Nelson and K. J. McCallum (Univ. of Saskatchewan, Saskatoon, Can.). Can. J. Chem. 36, 979-82(1958) June.

An investigation has been made of the chemical forms of the arsenic produced when solid bromides, following irradiation with high-energy gamma rays, are dissolved in aqueous solution. The As^{77} is found to appear in both the pentavalent and the trivalent forms, the ratio AsV/AsIII increasing with an increase in the number of moles of water present in the hydrated solid. For the

monohydrate of lithium bromide, the ratio depends upon the pH of the solution in which the solid is dissolved. (auth)

10451

CERTAIN FEATURES IN THE RADIATION DECOMPOSITION OF POLYMERS. A. B. Taubman and L. P. Yanova (Inst. of Physical Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 118, 991-3(1958) Feb. 11. (In Russian)

Investigations were made of the gas formation and its effects on the decomposition of polytetrafluoroethylene, polymethylmethacrylate, and polyethylene polymers during fast electron beam irradiation at various temperatures. (R.V.J.)

10452

HIGH TEMPERATURE RADIATION CHEMISTRY OF HYDROCARBONS. P. J. Lucchesi, B. L. Tarmy, R. B. Long, D. L. Baeder, and J. P. Longwell (Esso Research and Engineering Co., Linden, N. J.). Ind. and Eng. Chem. 50, 879-84(1958) June.

Radiation-induced cracking of pure hydrocarbons and mixtures is a long-chain reaction at 320° to 510°C. Product distributions are similar to those obtained with thermal cracking. The radiation yields (10^4 to 10^5) increase with increasing temperature, are lower in the liquid than the vapor phase, and increase at lower intensity. Radiocracking results from both cobalt-60 and pile work can be qualitatively explained by assuming the Rice-Herzfeld radical mechanism. Close agreement between calculated and predicted radiation yields indicates that atmospheric pressure radiocracking is an ordinary radical chain reaction. This gives new insight into the mechanism of thermal decomposition of hydrocarbons, which is believed to be a chain process of low chain length. (auth)

10453

HYDROGEN CONVERSION AND EXCHANGE REACTIONS IN AQUEOUS SOLUTIONS INDUCED BY GAMMA RAYS. Harold L. Friedman (Univ. of Southern California, Los Angeles) and Alfred H. Zeltmann (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 28, 878-90(1958) May.

Experimental studies were made of several γ-ray-induced reactions of hydrogen in aqueous solutions in which no net chemical change occurs. The most complete results were obtained at pH 2, where radiation-induced chain reactions are found in the conversion of parahydrogen and in the isotope exchange reactions of HD and of H_2-D_2 mixtures, but where there is only a nonchain exchange of D_2 with the solvent. The exchange data are in agreement with the earlier work of Gordon and Hart, but are more extensive in some respects. It is assumed that the chain conversion and exchange are carried by steps such as $H + H_2 \rightarrow H_2 + H$, and $H + D_2 \rightarrow HD + D$, and isotopically related reactions, and furthermore that these reactions have the same specific rate constants in solution as in the gas phase at the same temperature. All the data at pH 2 can then be correlated by a single mechanism and the following conclusions are reached. At the lower dose rates in solutions of H_2 the effective stationary-state concentration of H atoms is proportional to the dose rate, reaching 2×10^{-8} M at 10^{18} ev/l sec. The effective mean life of H atoms under these conditions is 0.2 sec. The rate constant of the reaction $H + H \rightarrow H_2$ in water at pH 2 is at most 1×10^8 l/mole sec. The pseudo first-order rate constant of the reaction $D + H_2O \rightarrow DOH + H$ in water at pH = 2 is 2 sec^{-1}. The last conclusion leads to an important restriction on the importance of H_2^+ in irradiated solutions, namely, H_2^+ cannot be in rapid equilibrium with H and H^+ or this would be a path for a fast exchange of D with H_2O. The investigation of other pH ranges is less complete than that at pH 2, but the conclusion of Gordon and Hart, that the stationary-state H atom concentration produced by γ rays is much lower in basic than in acid solution, has been confirmed. (auth)

10454

NITROGEN PENTOXIDE FORMATION BY IONIZING RADIATION. P. Harteck and S. Dondes (Rensselaer Polytechnic Inst., Troy, N. Y.). J. Chem. Phys. 28, 975-6(1958) May.

An experiment to ascertain the formation of nitrogen pentoxide by reactor irradiation of nitrogen–oxygen mixtures is reported. (J.E.D.)

10455

RADIATION CHEMISTRY OF CYCLOHEXANE. A. C. Nixon and R. E. Thorpe (Shell Development Co., Emeryville, Calif.). J. Chem. Phys. 28, 1004-5(1958) May.

The irradiations were carried out in N_2 atmosphere using the gamma radiation from spent fuel elements. Under the experimental conditions atmosphere exerted no significant influence on the total amount of cyclohexane reacted but did affect individual product yields. Neglecting gaseous products, 3.3 wt. % of the cyclohexane reacted. Bicyclohexyl is the major individual product of radiolysis. It is confirmed that the cyclohexyl ring is comparatively resistant to ring rupture. However extensive rearrangement of a five-membered ring system occurs. (J.E.D.)

10456

GRAFT INTERPOLYMERS FORMED BY γ-IRRADIATION OF METHYL METHACRYLATE-NATURAL RUBBER MIXTURES. D. J. Angier and D. T. Turner (British Rubber Producers', Welwyn Garden City, Herts, Eng.). J. Polymer Sci. 28, 265-74(1958) Mar.

On exposure to Co^{60} γ-radiation, mixtures of natural rubber and methyl methacrylate yield almost exclusively rubber-polymethyl methacrylate graft polymers. An appreciable amount of free polymethyl methacrylate is formed only in the presence of a transfer agent or following radiation-induced degradation of the interpolymer. Structural characterization of the products has been made. The findings are not consistent with random grafting of the synthetic polymer on linear rubber molecules of random molecular size distribution—the rubber component appears to comprise several crosslinked molecules. The influence of the purity of the rubber, monomer concentration, field intensity, the presence of transfer agent, and the gel effect on the rate of formation, yield, and structure of the interpolymer are reported. (auth)

10457

GAMMA-RADIATION CATALYSIS OF THE OXIDATION BY AIR OF TRI-ISOPROPYL PHOSPHATE. D. G. Coe (Suffield Experimental Station, Ralston, Alberta, Can.). Nature 181, 1519-20(1958) May 31.

From the infra-red examination of nominally pure samples of tri-isopropyl phosphite labeled with phosphorus-32 it appeared that large amounts of pentavalent phosphorus compounds were present. Since under similar experimental conditions unlabeled tri-isopropyl is unaffected, it appeared that the oxidation must have been due to the radiation present. A series of exploratory experiments to test this hypothesis are reported. Results were inconclusive. (C.H.)

10458
RADIATION CHEMISTRY OF SOLUTIONS. I. USE OF LEUCO TRIARYLMETHANE COMPOUNDS FOR CHEMICAL DOSIMETRY. W. A. Armstrong and G. A. Grant (Defence Research Chemical Labs., Ottawa, Ont., Can.). Radiation Research 8, 375-87(1958) May.

The effects of γ-radiation on acidic aqueous solutions of a number of 4,4'-thenylidene bis[N,N-dimethylaniline] compounds are described. The effects of pH, acid solvent, leuco concentration, added salts, and dissolved oxygen have been investigated. The most sensitive stable system prepared consisted of 10^{-4} M 4,4'-(5-chloro-2-thenylidene)bis[N,N-dimethylaniline], 10^{-4} M ferrous ammonium sulfate, 0.1 M sodium chloride, and 7×10^{-3} M hydrochloric acid. With this system a minimum dose of about 250 rads can be detected by visual observation of color change in a cell with path length of 1 cm. The optical density at the main absorption peak of 633 mμ increases linearly with increasing γ-ray doses from 0 to at least 2000 rads, and doses as low as 20 rads can be measured with a spectrophotometer with 10-cm cells. With the described experimental conditions, no postirradiation effects such as fading of the dye have been observed. Solutions can be stored in the dark for about 2 weeks prior to use, with little change in blank readings. (auth)

10459
OXIDIZING PROCESSES IN ORGANIC SYSTEMS CAUSED BY IONIZING RADIATION. N. A. Bakh and V. V. Saraeva (Lomonosov, Moscow State Univ.). Zhur. Fiz. Khim. 32, 209-17(1958) Feb. (In Russian)

The nature and the yield from the oxidizing reactions considering the ionization density, the molecular structure and composition of the irradiated materials, and the dose and temperature of irradiation were studied. The data on the radioinduced oxidation of hydrocarbons showed that the yield of the oxidation products depends on the structure of the hydrocarbons. The highest total yields were observed in aliphatic hydrocarbons and the lowest in benzenes. (R.V.J.)

Radiation Effects

10460
EFFECT OF PILE IRRADIATION ON THE DYNAMIC MECHANICAL PROPERTIES OF POLYETHYLENE. C. W. Deeley, D. E. Kline, J. A. Sauer, and A. E. Woodward (Pennsylvania State Univ., University Park). J. Polymer Sci. 28, 109-20(1958) Feb.

The effects of pile irradiation on the damping and resonant frequency of a "high pressure" polyethylene were investigated over a temperature range from 80 to 550°K in the audiofrequency region using an apparatus which drives rod-like specimens in their transverse modes. Using irradiation dosages which result in approximately 4% cross-linking or greater, the mechanical loss peaks found at about 165, 265, and 355°K in polyethylene are altered. Definite changes in the resonant frequency or modulus-temperature plots also occur. The 355°K peak, attributed to the melting of the crystalline portions of the sample, decreases in height and shifts to lower temperatures with increasing irradiation dose. A decrease in the height of the 265°K peak accompanied by a shift to higher temperatures takes place. The 165°K peak initially increases in height and peak temperature but at higher dosages a marked decrease in the damping maximum occurs. The damping behavior in the 165 and 265°K regions is discussed in terms of diffusional motion of chain segments in the amorphous polymer portions. (auth)

10461
THE EFFECT OF FERROUS SULFATE CONCENTRATION ON THE YIELD OF OXIDATION OF FERROUS ION BY RADIATIONS OF HIGH LET. Robert H. Schuler (Mellon Inst., Pittsburgh and Brookhaven National Lab., Upton, N. Y.). Radiation Research 8, 388-91(1958) May.

The usefulness of the biological thermal column of the Brookhaven Reactor in carrying out studies of the effect of scavenging agents on radiation chemical reactions produced by very densely ionizing radiations has been demonstrated. It has been shown that a 10% increase in the yield for oxidation of ferrous ion by the recoil radiations from the $B^{10}(n,\alpha)Li^7$ reaction accompanies an increase in ferrous sulfate concentration from 0.25 to 10 mM. This is in contrast to the negligible change in yield observed over this same concentration region for reactions produced by γ-radiation. These studies further stress the importance of scavenging processes in the case of densely ionizing radiations. (auth)

10462
RADIATION DAMAGE STUDIES OF SEVEN NON-FISSIONABLE METALS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 37, Session 26. C. A. Bruch and W. E. McHugh (Knolls Atomic Power Lab., Schenectady, N. Y.). New York, American Institute of Chemical Engineers, 1958. 69p.

Seven metals were irradiated under a variety of irradiation exposure conditions in three types of nuclear reactors. Measurements were made of both the exposure conditions and the resulting changes in properties. All of the metals experienced the same general effects, including increases in strength, hardness, and electrical resistance and decreases in ductility. It is doubtful that the range of neutron exposures covered was adequate to achieve saturation of the irradiation effects. Based on the experimental observations a qualitative picture of the radiation-damage process is suggested. If this proves to be correct, it may be possible to accelerate the evaluation of radiation damage to metals. Several general and empirical relationships are suggested which describe maximum observed changes in several properties. (auth)

10463
THE RELEASE OF STRAIN IN PRINCE RUPERT'S DROPS BY GAMMA IRRADIATION. Presented at Nuclear Engineering and Science Conference, held at Chicago March 17 to 21, 1958. Preprint 45, Session 5. Charles H. Greene (Alfred Univ., N. Y.). New York, American Institute of Chemical Engineers, 1958. 6p.

Prince Rupert's drops made from two kinds of glass were subjected to doses of cobalt-60 gamma radiation ranging up to 3.45×10^7 r. A slight amount of release of strain was observed after the maximum irradiation in drops made of a soft lead glass, Corning brand 0120. The brown color developed in the strained drops of the lead glass was more intense than that in control samples which had been annealed. These effects were much less marked in drops made from a hard borosilicate glass, Pyrex brand 7740 which was also less colored than was the lead glass by the same amount of irradiation. (auth)

Rare Earths and Rare-earth Compounds

10464
ON THE COMPLEX CHEMISTRY OF THE TERVALENT RARE EARTH IONS. I. THE ACETATE SYSTEMS OF

LANTHANUM, CERIUM, NEODYMIUM, AND GADOLINIUM. Arthur Sonesson (Univ. of Lund, Sweden). Acta Chem. Scand. 12, 165-81(1958).

The complexity constants of the acetate complexes of La^{3+}, Ce^{3+}, Nd^{3+}, and Gd^{3+} have been determined. The values of the complexity constants $\beta_n = [MA_n]/[M] \cdot [A]^n$ were found in perchlorate medium of ionic strength 2M at 20°C. The fourth constant must be considered only as a quantity formally computed from the potentiometric measurements, as an ion exchange investigation has shown that the cerium acetate system most probably does not contain anionic complexes to a detectable amount at acetate concentrations <500 mM. The value β_1 increases from La^{3+} to Nd^{3+}, which is expected on account of the decreasing ionic radius. The gadolinium acetate system, however, has a smaller β_1 than the neodymium system. (auth)

10465

NEW BORIDES OF RARE-EARTH ELEMENTS. V. S. Neshpor and G. V. Samsonov. Dopovidi Akad. Nauk Ukr. R.S.R. No. 5, 478-9(1957). (In Russian)

The borides of dysprosium, holmium and lutecium were obtained by means of the vacuum-thermal method. They were subjected to x ray and chemical analyses. Roentgenograms of all these compounds are very similar and indicate the presence in each of them of two phases: cubic and tetragonal. Therefore, the composition of these borides is as follows: DyB_6, DyB_4, HoB_6, HoB_4, LuB_6 and LuB_4. The lattice constants are tabulated. The intensities of the lines of the two phases in the roentgenograms are approximately equal; most of the lines are ascribed to the phase of MeB_4. (TCO)

10466

MODERN METHODS OF SEPARATION OF RARE EARTHS. I. N. Zaozerdkiy and Z. F. Andreyeva. Khim. Nauka i Prom. 1, No. 5, 515-17(1956). (Translated from Referat. Zhur. Khim. No. 9, 1957, Abstract No. 30266.)

10467

NEW QUALITATIVE REACTIONS FOR PRASEODYMIUM IN THE PRESENCE OF NEODYMIUM AND OTHER RARE-EARTH ELEMENTS OF THE CERIUM SUBGROUP. M. N. Ambrozhiy, L. M. Kul'berg, and A. G. Fedorova (Saratov Univ.). Uchenye Zapiski Saratov. Inst. 43, 149-53(1956). (Translated from Referat Zhur. Khim. No. 9, 1957, abstract no. 30987.)

Topochemical oxidation-reduction reactions have been developed for detection of Pr in the presence of Nd and other rare-earth elements of the Ce group. It was found that of the 7 qualitative reactions which have been studied the most effective are those utilizing the leuco-compounds of the triphenyl methane dyes (leuco malachite green, leuco brilliant green, and leuco-compounds of crystal violet). As a reagent for Pr in admixture with other rare-earth elements, octamethyl tetramino tetraphenyl ethylene, diethyl-p-phenylene diamine, and dimethyl-p-phenylene diamine can also be used.

10468

DETERMINATION OF CONCENTRATION OF SOLUTIONS OF RARE EARTH ELEMENTS BY THE METHOD OF TREATMENT WITH CATHIONITE. V. P. Khramov (Saratov Univ.). Uchenye Zapiski Saratov. Inst. 43, 159-62(1956). (Translated from Referat. Zhur. Khim. No. 9, 1957, abstract no. 30984.)

The solution under study (25 to 50 ml), containing 5 to 20 mg of cation, is filtered 5 to 6 times through a layer of NSK cathionite, in the H-form, at a rate of 2 to 5 drops per second (it is possible to filter only once at a rate not exceeding 10 ml/minute). The cathionite is washed with water until neutral to methyl orange; filtrate (+ washings) is titrated with 0.01 N solution of alkali, to methyl orange. Concentration of the salt in the solution is calculated in accordance with the formula $x = E \times Na/1000$, where E = equivalent of rare earth element, N = normality of alkali solution, a = amount of alkali (in ml) used up in the titration. Deviation from results of gravimetric method is not above 2% for $Ce(NO_3)_3$, $Pr(NO_3)_3$, $Nd_3(NO_3)_3$, and up to 5% for $La(NO_3)_3$.

Separation Procedures

Refer also to abstract 10576.

10469 AERE-C/R-2454

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

HEAD-END PROCESSES FOR DISSOLVING STAINLESS STEEL–UO_2 DISPERSION TYPE FUEL ELEMENTS. I. CARBIDE AND NITRIDE TREATMENTS. II. ANODIC DISSOLUTION. F. S. Martin and M. J. Waterman. Jan. 1958. 17p.

The treatment of 18-8-1 type stainless steel plate with ammonia or methane at about 1000°C renders the metal more susceptible to dissolution in nitric acid. The rate of penetration (of carbide or nitride) is very slow, and the method does not seem to be very suitable, except for the treatment of very thin plates (~0.025" thickness). Stainless steel and stainless steel–UO_2 cermets dissolve readily in nitric acid if an anodic potential is applied. High current efficiencies are obtainable with d-c and moderate efficiencies with a-c. A wide range of initial nitric acid concentrations may be used, and dissolution may be carried to the point where large quantities of ferric hydroxide are precipitated. Uranium recoveries are > 99.5%. The bulk of the fission product activity is found in solution, but fission product niobium is associated with traces of insoluble residue. The method would be suitable for the dissolution of large pieces of stainless steel (e.g., whole fuel elements) where individual electrical contacts may be made external to the solution; it would not be suitable where large numbers of small pieces have to be held (e.g., in a platinum basket), due to the almost negligible current efficiencies that are obtained in such cases. (auth)

10470 CF-58-2-135

Oak Ridge National Lab., Tenn.

DAREX PROCESS: BATCH DISSOLUTION AND CHLORIDE REMOVAL STEPS FOR YANKEE ATOMIC FUEL. J. H. Goode and J. R. Flanary. Feb. 21, 1958. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

In laboratory scale experiments dilution of a Darex dissolver product from the integral dissolution of Yankee Atomic fuel specimens with at least an equal volume of 15.8M HNO_3, followed by distillation, produced a solvent extraction feed containing less than 50 ppm of chloride. Properly designed chloride stripping and nitric acid rectification columns are capable of conserving acids for recycle to the dissolver and chloride removal still. In initial experiments about 87% of the nitric acid and 36% of the hydrochloric acid were recovered. (auth)

10471 HW-55974
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
TEMPERATURE OBSERVATIONS—REDOX PLANT SILVER REACTORS. G. L. Henson. May 7, 1958. 10p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The effects of temperature on the Redox Plant silver reactors were studied. The results suggested that better control of radioiodine could be obtained in the silver reactors by operating the reactors at influent gas temperatures not exceeding 375°F during dissolving of the Al jackets, and operating the reactors at influent gas temperatures above 375°F (but below 414°F) during the dissolving of the U metal. In-plant tests were made of silver reactor operation as a function of gas inlet temperature to determine effects on iodine removal efficiency and silver reactor life expectancy. (W.L.H.)

10472 HW-54819
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PROBLEMS ASSOCIATED WITH THE CHEMICAL PROCESSING OF ALUMINUM—SILICON—PLUTONIUM FUEL MATERIALS. E. E. Voiland. Apr. 1, 1958. 13p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The Al—Pu—Si system having been proposed as fuel material for the Plutonium Recycle Test Reactor, its behavior in chemical processes was investigated. The Si reduced the dissolution rate and would not dissolve in HNO_3. An $HF-HNO_3$ system would dissolve it but equipment corrosion, volatile fluorides and other problems result. Dissolution in boiling NaOH results in a colloidal solution which resists coagulation. These and other findings lead to a recommendation not to use Si. (T.R.H.)

10473 ISC-998
Ames Lab., Ames, Iowa.
A POLYETHYLENE BOX-TYPE MIXER-SETTLER EXTRACTOR. Lester Knapp, Roman Schoenherr, John Barghusen, and Morton Smutz. Jan. 1958. 23p. Contract [W-7405-eng-82]. $0.75(OTS).

Some distinguishing characteristics of the polyethylene box-type mixer-settler are: a built-in interface controller adjustable during operation; both phases enter the mixing chamber along the impeller axis; the impeller pumps the phases through the extractor; compactness—no interstage piping; unlimited number of stages; no back-mixing; and wide range of impeller speeds. A 300-hr run with rare-earth nitrate—TBP system, 10 times as viscous as water, was quite satisfactory. (T.R.H.)

10474 M-2846(Del. 2)
Monsanto Chemical Co., Dayton, Ohio.
RESEARCH ON THE ELECTRODEPOSITION OF POLONIUM [FOR PERIOD] NOVEMBER 1, 1943—MAY 1, 1946. John W. Schulte. June 20, 1946. Decl. with deletions Dec. 6, 1957. 85p. (M3-D537(Del. 2); Final Report No. 14(Del. 2)). $13.80(ph OTS); $4.80 (mf OTS).

Methods for preparing concentrated polonium sources by electrolysis of bismuth contaminated solutions were investigated. The results from experiments using the following solutions are presented: nitric acid, hydrochloric acid, sulfuric acid, hydrofluoric acid, phosphoric acid, perchloric acid, oxalic acid, tartaric acid, citric acid, acetic acid, sodium cyanide, and sodium hydroxide. Photographs of the deposits obtained are shown. Electrolytic cell and handling equipment designs are given. (D.E.B.)

10475 ORNL-1801(Del.)
Oak Ridge National Lab., Tenn.
THE EFFECT OF ACIDITY AND REDUCING AGENTS ON RUTHENIUM SOLVENT EXTRACTION BY TRIBUTYL PHOSPHATE IN THE 25 PROCESS. J. R. Flanary and L. D. Frashier. Dec. 15, 1954. Decl. with deletions Mar. 6, 1958. 16p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Results of tracer studies suggest that, in tributyl phosphate extraction processes designed to recover and purify fissionable material, minimum ruthenium extraction should be obtained from feeds at least 2 M in nitric acid or at least 1 M acid-deficient. Ruthenium decontamination was decreased by preheating the feed and increased by pretreatment with reducing agents. A pretreatment using 0.06 M ferrous ion and 0.5 M urea with 1 hr simmering at 85°C should increase ruthenium decontamination about 10-fold in the 25 Process. If other process considerations dictate the use of a low-acid feed, decontamination from ruthenium may be improved by using 3 M nitric acid as the scrubbing solution. Apparently, the scrubbing process is quite time-dependent; a solvent holdup time of about 15 min may be needed in the scrub section for maximum decontamination. (auth)

10476 TID-5224
Columbia Univ., New York.
CHEMICAL SEPARATION OF THE URANIUM ISOTOPES. Clyde A. Hutchison, Jr.—George M. Murphy, ed. 1952. Decl. with deletions Feb. 27, 1957. 178p. Contract W-7405-eng-50. $4.75(OTS).

This is a deleted version of NNES-III-3.

This volume describes studies made to find a two-phase system suitable for counter-current fractionation of the U isotopes. Systems studied included gas-liquid systems, liquid-liquid systems, gas-solid systems, and liquid-solid systems. No system was found that possessed sufficient chemical stability, a sufficiently rapid exchange of U, and an appreciable separative effect. The design, development, and fabrication of standard vacuum or other system equipment from fluorinated plastics which enabled the handling of fluorides in transparent and nonreactive systems are also described. Methods for the preparation of samples for mass spectrometric analysis are given. (W.L.H.)

10477 USNRDL-TR-228
Naval Radiological Defense Lab., San Francisco.
ANION-EXCHANGE BEHAVIOR OF SEVERAL METAL IONS IN HCl, HNO_3, AND H_2SO_4 SOLUTIONS, WITH DOWEX-2. L. R. Bunney, N. E. Ballou, J. Pascual, and S. Foti. May 12, 1958. 14p.

Distribution coefficients were measured for Am, Ce, Mo(VI), Pa, Ru, Sr, Th, U(VI), Y, and Zr in the systems Dowex-2—HCl, Dowex-2—HNO_3, and Dowex-2—H_2SO_4. The acid concentrations ranged from 0.1N to concentrated. Sr, Y, Ce, and Am did not show any significant adsorption in any of the systems studied. A number of elements showed strong adsorption at low concentrations of H_2SO_4. Th, U(VI), and Zr show an adsorption maximum at approximately 8N HNO_3. (auth)

10478 AEC-tr-3216
CLASSIFICATION EFFICIENCY OF A TWO-STAGE HYDRAULIC CYCLONE. Naoya Yoshioka, Yutaka Hotta, and Tsutomu Mizutani. Translated from Chem. Eng. (Japan) 21, 32-6(1957). 13p.

A two-stage hydraulic cyclone system is described which classifies particles into four classes. A recovery curve and data on the ratio of accumulation of certain sizes of particles are included. The classification efficiencies of one- and two-stage hydraulic cyclone

systems are compared. Data are tabulated. 8 figures. (C.H.)

10479

COLLECTION OF INTEGRATED SAMPLES OF GASEOUS EFFLUENTS. Richard S. Brief (Esso Research and Engineering Co.) and Philip A. Drinker Massachusetts Inst. of Tech., Cambridge). Arch. Ind. Health 17, 654-8(1958) June.

A method is described for collecting gaseous samples of effluents from both cyclic and continuous industrial operations. The equipment is simple and easily operated to give samples which can be analyzed by mass spectrometry. (C.H.)

10480

SEPARATION OF NIOBIUM, TANTALUM, AND TITANIUM BY EXTRACTION. F. V. Zaikovskii (All Union Scientific Research Inst. of Economic Mineralogy, Moscow). J. Anal. Chem. U.S.S.R. (English Translation) 11, 277-84(1956) May–June.

This paper was previously abstracted from the original language and appears in NSA, Vol. 10, as abstract No. 10089.

10481

SEPARATION OF MAGNESIUM, ALUMINUM, CHROMIUM, MANGANESE, IRON, NICKEL, AND COPPER BY AN ION-EXCHANGE METHOD. D. I. Ryabchikov and V. F. Osipova (V. I. Vernadsky Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR, Moscow). J. Anal. Chem. U.S.S.R. (English Translation) 11, 285-91(1956) May–June.

This paper was previously abstracted from the original language and appears in NSA, Vol. 10, as abstract No. 10090.

10482

RECOVERY OF URANIUM FROM STAINLESS STEEL FUEL ELEMENTS. Leonard W. Niedrach, Arthur C. Glamm, Mary E. Brennan, and Burton E. Dearing (General Electric Co., Schenectady, N. Y.). Ind. Eng. Chem. 50, 763-6(1958) May.

An investigation was undertaken to provide data required for the "head-end step" of a process for recovering uranium from spent uranium dioxide stainless steel fuel. The step consisted of dissolution of the stainless steel cladding in sulfuric acid, dissolution of the uranium oxide fuel in nitric acid–sulfuric acid mixture, and a single solvent extraction cycle using 10% tributyl phosphate in a hydrocarbon diluent to separate the uranium from the stainless steel components. This treatment was designed to be compatible with further solvent extraction processing to be carried out in the chemical processing facilities at the reactor test station in Idaho. (auth)

10483

EQUILIBRIUM STUDIES ON NATURAL ION-EXCHANGE MINERALS. II. CAESIUM, SODIUM AND AMMONIUM IONS. C. B. Amphlett and L. A. McDonald (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 6, 145-52(1958) Apr.

Isotherms and values of thermodynamic equilibrium constants were derived for exchange within the systems Cs^+-Na^+ and $Cs^+-NH_4^+$ upon lower greensand soil; solid phase activity coefficients were also calculated. The results are compared with those of other workers on pure clay minerals; as in the case of the Cs^+-Sr^{2+} exchange, it is found that the equilibrium is less favorable towards Cs than for pure montmorillonite, but more so than for attapulgite, confirming the intermediate position of the mixed-clay mineral in the case of the soil. (auth)

10484

URANIUM AND PLUTONIUM EXTRACTION BY ORGANOPHOSPHORUS COMPOUNDS. L. L. Burger (General Electric Co., Richland, Wash.). J. Phys. Chem. 62, 590-3(1958) May.

Organic phosphates, phosphonates, phosphinates, and phosphine oxides are compared as solvents for uranium and plutonium nitrates. Distribution coefficients for U(VI) and Pu(IV) and (VI) indicate a large difference in solvent strength among these groups of compounds. The introduction of an electronegative group greatly reduces the solvent strength. The P—O stretching frequency can be correlated with solvent strength for these compounds. Some solid complexes of the organophosphorus compounds with uranyl nitrate have been isolated. (auth)

10485

SEPARATION OF LANTHANUM FROM THORIUM BY ANION EXCHANGE. Tatsuya Sekine and Nobufusa Saito (Univ. of Tokyo). Nature 181, 1464-5(1958) May 24.

The anion exchange behavior of thorium in sulfuric acid solution and the separation of lanthanum from thorium by anion exchange were investigated. (C.H.)

10486

GENERAL ECONOMICS OF CHEMICAL REPROCESSING USING SOLVENT EXTRACTION PROCESSING. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 22, Session 37. F. L. Culler, Jr. (Oak Ridge National Lab., Tenn.). New York, American Institute of Chemical Engineers, 1958. 27p.

The competitive requirement of producing electricity at 8 mills/kwh in the United States places limitations on the over-all recycle costs of irradiated fuel and fertile material. The cost for the recycle of fuel, including decay cooling, radiochemical separations, metallurgical reprocessing, fuel element fabrication, and waste disposal, probably cannot exceed 0.75/kwh of electricity for reactors that cost $250/kw of installed capacity. To achieve radiochemical separations for costs much less than 0.75 mill/kwh of electricity, assuming that 4000 megawatt days of heat are extracted per ton of natural uranium fuel or its equivalent, the radiochemical processing plants must be large and capable of processing the output of many reactors; the economic size of a chemical plant may be of such a size that it will require the irradiated fuel and blanket material from twenty 500 MW electrical reactors. The throw-away case for fuel has been studied for natural, partially enriched, and highly enriched uranium as well as thorium and U^{233}. Based on buy-back prices published by the Atomic Energy Commission, the residual value of fissionable and fertile material in irradiated fuel is almost always greater than the cost of recycle. Reprocessing will always be required. The concept of the central chemical plant makes transportation of irradiated fuel an economic necessity. Costs of transporting irradiated fuel by rail for distances as great as 1000 miles are not restrictive for most reactor types. (auth)

10487

MECHANICAL DISASSEMBLY OF SPENT POWER-REACTOR FUELS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 39, Session 34. W. W. Barton and J. J. Brooks (American Machine and Foundry Co., Greenwich, Conn.). New York, American Institute of Chemical Engineers, 1958. 30p.

Mechanical disassembly appears to be a promising alternative to chemical head-end methods for the preparation of spent power-reactor fuels for reprocessing. Most of the inert structural material is removed and the fuel itself is exposed for rapid dissolution in nitric acid. Such difficult-to-dissolve materials as stainless steel and Zircaloy-2 are eliminated from the subsequent chemical separation process, and the total quantity of material to be handled in the separation process is reduced to a minimum. In addition, the inert material of the fuel element assemblies is disposed of as solids instead of as processed liquid wastes. Conceptual designs of proposed mechanical disassembly machines and facilities are presented. Metallic-pin, metallic-rod, metallic-plate and ceramic fuel element assemblies are handled. Throughput is one ton per day of natural or slightly enriched uranium and 25 kilograms per day of highly enriched uranium. (auth)

Sorption Phenomena

10488 CF-58-5-59
Oak Ridge National Lab., Tenn.
PROPOSED METHOD FOR REMOVAL OF RADIOIODINE VAPOR FROM EXPERIMENT OFF-GAS SYSTEM OF THE ORR. R. E. Adams and W. E. Browning. May 21, 1958. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Various methods of removing radio-iodine from air streams were surveyed for possible use in removing radio-iodine accidentally released from reactor experiments into the experiment off-gas system of the ORR. Solid adsorber materials appear to be best suited for this purpose. An iodine decontamination factor of 2000 was experimentally determined for activated charcoal and Linde Molecular Sieve Material (13X) using I^{131} to simulate mixed radioisotopes of iodine. A conceptual design for an iodine trap containing activated charcoal is presented. The iodine removal efficiency of this hypothetical trap is discussed under conditions resulting from discharge of 3.0×10^4 curies of mixed radioisotopes of iodine into the ORR experiment off-gas system. (auth)

10489 NP-tr-100
ON THE SIGNIFICANCE OF ELECTROCHEMICAL METHODS IN THE INVESTIGATION OF THE NATURE OF SURFACE COMPOUNDS. A. N. Frumkin. Translated by E. Jarvesoo (Amherst Coll., Mass.) from p.53-8 [of] Poverkhnostnye Khimicheskie Soedineniya i ikh Rol v Yavleniyakh Adsorbtsii, Sbornik Trudov Konferentsii Po Adsorbtsii. Moscow, 1955. Moscow Univ. Press, 1957. 6p.

The strength of bonding of oxygen adsorbed on carbon, "hydrogenated" carbon, and metals is discussed. (T.R.H.)

10490 NP-tr-101
THE SUPER-EQUIVALENT ADSORPTION OF CATIONS ON A NEGATIVELY CHARGED SURFACE OF MERCURY. A. N. Frumkin, B. B. Damaskin, and N. V. Nikolaeva-Fedorovich. Translated by Elmar Jarvesoo, (Amherst Coll., Mass.) from Doklady Akad. Nauk S.S.S.R. 115, 751-4(1957). 7p.

Measurements were made of differential capacity of cations on a negatively charged surface in the presence of an anion whose adsorption in the surface layer affects the magnitude of the differential capacity. These and other experiments are discussed in relation to the super-equivalent adsorption of cations in a surface. (T.R.H.)

10491
SYNTHETIC INORGANIC ION-EXCHANGE MATERIALS. I. ZIRCONIUM PHOSPHATE. C. B. Amphlett, L. A. McDonald, and M. J. Redman (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 6, 220-35(1958) June.

Some of the properties of zirconium phosphate are given as an example of a class of very stable synthetic inorganic ion-exchange materials, which may be prepared in granular form suitable for column operations. It exhibits properties typical of a polyfunctional, weakly acid cation exchanger, with capacities up to ~5 mequiv/g in alkaline solution. Materials with a low phosphate:zirconium ratio possess in addition anion-exchange properties due to anions retained in the structure from the original zirconium salt. Cations may be exchanged rapidly and reversibly upon acid phosphate groups in the gel structure. Distribution coefficient measurements for alkali metal and alkaline earth ions have been made, and the material shows promise for separation purposes; uptake is reduced at elevated temperatures owing to hydrolysis. The stability of the material towards water at temperatures up to 300°C suggests its possible use for water treatment in high-temperature systems, as well as other possibilities. (auth)

10492
SYNTHETIC INORGANIC ION-EXCHANGE MATERIALS. II. HYDROUS ZIRCONIUM OXIDE AND OTHER OXIDES. C. B. Amphlett, L. A. McDonald, and M. J. Redman (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 6, 236-45 (1958) June.

The oxides ZrO_2, ThO_2, and TiO_2 behave as anion exchangers in acid and neutral solution and cation exchangers in alkaline solution, the pH at which their behavior changes depending upon the oxide itself and possibly also upon the nature of the exchanging ion. The oxides have been prepared in granular form and their reversible reactions with ions in solution have been studied; they are monofunctional exchangers, with appreciable rates of exchange, and display the expected affinity towards ions in solution. Owing to their weakly basic nature, exchanged ions are readily removed by treatment with water. When ZrO_2 is treated with phosphoric acid it is converted into zirconium phosphate. The reaction cannot be solely one of anion exchange, but must involve breakdown of the oxide and introduction of further acid phosphate groups by neutralization. WO_3 is a cation exchanger in acid solution, but dissolves in alkaline solution. (auth)

Spectroscopy

Refer also to abstract 10431.

10493
CHARACTERISTIC FREQUENCIES OF TRIMETHYLBORANE. Walter J. Lehmann, Charles O. Wilson, Jr., and I. Shapiro (Olin Mathieson Chemical Corp., Pasadena, Calif.). J. Chem. Phys. 28, 777-80(1958) May.

Contrary to previously published values, the characteristic B–C asymmetric stretching mode in trialkylboranes is assigned to the 1116 to 1150 cm^{-1} range. The basis for the assignment of the various characteristic bond vibrations is the comparison of the infrared spectrum of trimethylborane-b^{10} with the infrared and Raman spectra of isotopically normal trimethylborane. The new values lead to better consistency with spectra of other trialkylboranes and alkyldiboranes. (auth)

10494
CHARACTERISTIC FREQUENCIES OF TRIETHYLBORANE. Walter J. Lehmann, Charles O. Wilson, Jr., and I. Shapiro (Olin Mathieson Chemical Corp., Pasadena, Calif.). J. Chem. Phys. 28, 781-4(1958) May.

The infrared spectra of isotopically normal and triethylborane b^{10} are reported, and the major bands are assigned to the characteristic bond vibrations of the molecules. Analogous to trimethylborane, the asymmetric B–C stretching frequency is placed at ca. 1120 cm^{-1}. In view of the complexity of the molecule a more complete assignment is not feasible at this time. (auth)

10495
ELEMENTARY PROCESSES IN THE RADIOCHEMICAL EXCITATION OF GASEOUS OXYGEN. K. J. Laidler and E. Kerry Gill (Univ. of Ottawa, Can.). Trans. Faraday Soc. 54, 633-9(1958) May.

Theoretical and experimental evidence is adduced for the various excited states of O_2, O_2^+, and O_2^-. Based on spectroscopic, thermochemical and electron-impact data potential-energy curves are constructed for the various states of the positively and negatively charged oxygen ions. The detailed processes occurring when electrons of various energies interact with oxygen molecules are then considered and it is shown that it is now possible to develop a self-consistent scheme for the various elementary processes. (auth)

Syntheses

10496
PREPARATION OF THE NIOBIUM(IV) AND NIOBIUM(III) IODIDES. John D. Corbett and Pyrtle X. Seabaugh (Iowa State Coll., Ames). J. Inorg. & Nuclear Chem. 6, 207-9(1958) June.

Conditions are reported for the preparation of NbI_5, the preparation and sublimation of NbI_4 by thermal decomposition of the pentaiodide, and the subsequent disproportionation to NbI_3. Properties and powder patterns are given for the three iodides. (auth)

Tracer Applications

10497
SOME APPLICATION OF RADIOISOTOPES TO THE PETROLEUM INDUSTRY. A. Scaroni (CISE, Milan). Energia nucleare (Milan) 5, 297-306(1958) May. (In Italian)

Some of the main applications of radioisotopes to the petroleum industry are reported. In particular a review is given of laboratory research works, tests of special materials, well logging, drilling procedures, and plant operation controls which are of particular interest owing to their large and practical applications. Data are also reported concerning radiation effects on thermal cracking operations. (auth)

Transuranic Elements and Compounds

Refer also to abstract 10386.

10498 AECL-543
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE PREPARATION OF PLUTONIUM–ALUMINUM AND OTHER PLUTONIUM ALLOYS. O. J. C. Runnalls. Jan. 1958. 34p. $1.00(AECL).

The preparation of plutonium–aluminum alloys by the direct reduction of plutonium trifluoride and plutonium dioxide is described. Plutonium trifluoride is reduced more rapidly at 900°C than at 1125°C with liquid aluminum owing to the evolution of gaseous aluminum monofluoride at the lower temperature. Plutonium dioxide is reduced readily by an excess of liquid aluminum at 1200°C in the presence of liquid cryolite, forming plutonium–aluminum alloys with a plutonium yield above 99%. The preparation of other binary plutonium alloys by the reduction of plutonium fluorides or dioxide with beryllium, gallium, magnesium, silicon, thorium, and uranium is also described. (auth)

10499 ORNL-2530
Oak Ridge National Lab., Tenn.
SOLUBILITY AND STABILITY OF PuF_3 IN FUSED ALKALI FLUORIDE–BERYLLIUM FLUORIDE MIXTURES. C. J. Barton, W. R. Grimes, and R. A. Strenhlow. June 26, 1958. 37p. Contract W-7405-eng-26. $1.25(OTS).

The solubility of PuF_3 in one NaF–LiF–BeF_2 mixture, three NaF–BeF_2 mixtures and four LiF–BeF_2 mixtures was determined at temperatures ranging from about 550 to 650°C. Solubility-composition diagrams for the binary systems at 565°C show that in the LiF–BeF_2 system a minimum solubility of 0.25 mole % PuF_3 occurs at about 63 mole % LiF while in the NaF–BeF_2 system the minimum solubility of 0.18 mole % PuF_3 occurs at approximately 57 mole % NaF. In both systems, the solubility increases rather slowly on adding BeF_2 to the composition exhibiting minimum solubility but increases quite rapidly on adding alkali fluoride to this composition. The highest solubility observed at 565°C was 1.2 mole % PuF_3 in the mixture NaF–LiF–BeF_2 (56.5 to 17.5 to 26 mole %). In fused LiF–BeF_2–PuF_3 mixtures, the only plutonium species observed with the help of a polarizing microscope was PuF_3 but another compound believed to have the formula $NaPuF_4$ was found in the fused NaF–BeF_2–PuF_3 mixture containing 64 mole % NaF and in the mixture resulting from the addition of PuF_3 to the ternary solvent composition. No evidence of disproportionation of PuF_3 was found in the course of the solubility studies. (auth)

10500
REDUCTION OF NEPTUNIUM TO THE TRIVALENT STATE BY CHEMICAL METHOD. A. D. Gel'man and M. P. Mefod'eva. Atomnaya Energiya 4, 271-4(1958) Mar. (In Russian)

Spectrographic analysis showed that Np(IV) is reduced to Np(III) by rongalite. The reaction takes place in a nitrogen or air atmosphere; however, in the nitrogen atmosphere the recovery and stability of Np(III) are higher. It is also shown that an increase in the general content of the reducing agent (in the solution of hydrazinerongalite) affects favorably the reduction of Np up to the trivalent state. In nitric acid solutions the Np recovery averages 70% and in the hydrochloric acid up to 95%. In the rongalite reduction of Np(V) the Np(IV) and Np(III) form a mixture in which the Np(III) shows considerable resistance to oxidation by air. (tr-auth)

10501
THE PROPERTIES OF INORGANIC COMPOUNDS IN ORGANIC SOLVENTS. I. THE HYDROLYSIS AND POLYMERIZATION OF QUADRIVALENT PLUTONIUM NITRATE SPECIES IN DIETHYLENE GLYCOL DIBUTYL ETHER. D. G. Tuck (United Kingdom Atomic Energy Authority, Industrial Group, Windscale Works, Cumberland, Eng.). J. Inorg. & Nuclear Chem. 6, 252-6(1958).

Color changes in weak acid solutions of plutonium tetranitrate in diethylene glycol dibutyl ether have been

shown to be due to hydrolysis, and subsequent formation of a polymeric form of Pu^{4+}, which shows many correspondences with the colloid formed in aqueous solution. The polymer appears to be fairly stable in this solvent at room temperature but on heating the solution, a precipitate is formed; x-ray analysis shows that this is a hydrated plutonium dioxide. A possible reaction scheme for the formation of the polymer is discussed. (auth)

10502

THE ABSORPTION SPECTRUM OF AQUEOUS CURIUM (III). W. T. Carnall, P. R. Fields, and D. C. Stewart (Argonne National Lab., Lemont, Ill.) and T. K. Keenan (Los Alamos Scientific Lab., N. Mex.). J. Inorg. & Nuclear Chem. 6, 213-16(1958) June.

The absorption spectrum of aqueous curium^{3+} has been studied in 0.04 N $HClO_4$, using the isotope Cm^{244}. Three prominent absorption peaks have been discovered at 3754 A, 3812 A, and 3965 A, in addition to absorption in the far ultra-violet. These same peaks are found in HCl, HNO_3, and H_2SO_4 solutions. The general characteristics of the spectra in these three acids and some general observations on the radiation decomposition of aqueous curium solutions are reported. (auth)

10503

KINETICS OF OXIDATION REDUCTION REACTIONS OF PLUTONIUM. THE REACTION BETWEEN PLUTONIUM(VI) AND PLUTONIUM(III) IN PERCHLORATE SOLUTION. Sherman W. Rabideau and Robert J. Kline (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 62, 617-20(1958) May.

The rapid, reversible reaction, $Pu^{+3} + PuO_2^{+2} \rightarrow Pu^{+4} + PuO_2^{+}$, was studied spectrophotometrically by following the rate of disappearance of PuO_2^{+2} through the absorption peak at 8304 A. The reaction rates were found to be conveniently measurable even at temperatures of 35° with concentrations of PuO_2^{+2} and Pu^{+3} in the 10^{-4} and 10^{-3} M ranges, respectively. The reaction is first order in each of the reactants and is independent of the hydrogen ion concentration over the ranges of acidity investigated: namely, 0.1 to 1.0 M. Specific reaction rate constants as functions of temperature have been obtained for both the forward and the reverse reactions in deuterium oxide and in ordinary aqueous perchloric acid solutions of unit ionic strength. Heats, free energies and entropies of activation have been obtained for both forward and reverse reactions in the two solvents. The observation was made that the specific reaction rate constant for the forward reaction decreased by a factor of 1.7 upon changing the solvent from ordinary water to deuterium oxide; however, the specific reaction rate constant for the back reaction was greater by a factor of 1.5 in the deuterium oxide solvent. Thus at comparable acidities, the value of the equilibrium quotient, $[PuO_2^{+2}][Pu^{+3}]/[Pu^{+4}][PuO_2^{+}]$, increases approximately threefold upon changing the solvent from ordinary water to deuterium oxide. Addition of chloride ion to an extent threefold greater than the total plutonium concentration did not bring about a measurable change in either the forward or the reverse specific reaction rate constants. (auth)

10504

THE NITRATE COMPLEXES OF TETRAVALENT PLUTONIUM. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 8, Session 37. J. A. Brothers, R. G. Hart, and W. G. Mathers (Atomic Energy of Canada, Ltd.). New York, American Institute of Chemical Engineers, 1958. 15p.

An equilibration technique using liquid amines possessing ion exchange properties has been used to study the nitrate complexes of tetravalent plutonium. It has been shown that practically all the plutonium present in nitrate salt solutions above 1 M or in 1 to 4 M nitric acid is present as undissociated $Pu(NO_3)_4$. The plutonium species which absorbs on anion exchange resins has been shown to be $Pu(NO_3)_6^{2-}$. A study of the spectra in liquid amine–toluene solution and in 11 M nitric acid has led to the conclusion that $H_2Pu(NO_3)_6$ is the sole tetravalent plutonium species present in strong nitric acid. Spectra at intermediate nitric acid concentrations suggest the possibility of the existence of the species $HPu(NO_3)_5$. (auth)

Uranium and Uranium Compounds

Refer also to abstracts 10393 and 10476.

10505 CF-58-5-63

Oak Ridge National Lab., Tenn.

THE CRYSTAL STRUCTURE OF RbU_6F_{25}. L. A. Harris. May 15, 1958. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The compound RbU_6F_{25} has a hexagonal crystal structure with the parameters $a_0 = 8.195 \pm 0.002$ A and $c_0 = 16.437 \pm 0.002$ A. This compound is believed to be isomorphous to KU_6F_{25} and KTh_6F_{25}. (auth)

10506 NP-6722

[Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.]

OXYGEN DISSOCIATION PRESSURES OVER URANIUM OXIDES. Scientific Paper 100FF942-P1. P. E. Blackburn. Jan. 15, 1957. 31p.

Oxygen dissociation pressures over the uranium oxides, $UO_{2.0}$ to $UO_{2.6}$, were measured between 950 and 1150°C by the Knudsen effusion method. In this temperature and composition range there are three stable uranium oxides: UO_2 in which the solubility of oxygen increases with temperature, U_4O_9 which exists up to 1167°C with a narrow homogeneity range, and U_5O_{13} in which oxygen dissolves. A phase diagram of the uranium–oxygen system was constructed, thermodynamic values were derived and the accommodation coefficient of oxygen on U_4O_9 was estimated to be 0.027. (auth)

10507 RDB(CAP)/TN-96(Del.)

Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.

A CALCULATION OF THE LIQUID-VAPOUR EQUILIBRIUM IN THE TERNARY SYSTEM URANIUM HEXAFLUORIDE–CHLORIDE TRIFLUORIDE–HYDROGEN FLUORIDE. J. S. Rowlinson. Sept. 1953. Decl. Nov. 22, 1957. 15p.

A statistical theory of solutions is used to calculate the liquid–vapor equilibrium for the ternary system uranium hexafluoride–chlorine trifluoride–hydrogen fluoride from a knowledge of the behavior of the three binary systems. The conditions under which chlorine trifluoride and hydrogen fluoride could be removed from uranium hexafluoride by fractional distillation are discussed. (auth)

10508 RFP-100

Dow Chemical Co. Rocky Flats Plant, Denver.

METALLOGRAPHIC STRUCTURE ANALYSIS OF URANIUM BY PREFERENTIAL OXIDATION. A. E. Calabra. Feb. 19, 1958. Decl. May 27, 1958. 15p. Contract AT(29-1)-1106. $3.30(ph OTS); $2.40(mf OTS).

The preferential oxidation process takes advantage of the anisotropic characteristic of U in that the ex-

posed surfaces of the randomly oriented grains exhibit different rates of oxidation at the same temperature. The amount of oxide or thickness of the oxide layer formed upon each grain surface or at the grain boundaries thus affords a means of distinguishing each grain and its deformations, such as the presence of slip and/or twin planes. The preferential oxidation method is applicable for all uranium. (W.L.H.)

10509 TID-5522

Battelle Memorial Inst., Columbus, Ohio.

RE: ELEVATED-TEMPERATURE CREEP TESTS OF BETA-QUENCHED URANIUM. J. R. Keeler. Sept. 18, 1956. Decl. Mar. 28, 1958. 4p. (GEH-23103). $1.80 (ph OTS); $1.80(mf OTS).

Deformation-time curves are given for beta-quenched uranium at various pressures and temperatures. (W.L.H.)

10510 WAPD-PWR-PMM-491

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

RÉSUMÉ OF URANIUM OXIDE DATA—VII. J. Belle and L. J. Jones. Sept. 12, 1956. Decl. June 25, 1957. 145p. Contract AT-11-1-GEN-14. $3.75(OTS).

A survey of development in preparation and properties of uranium dioxide was made, including powder preparation, physical measurements, fabrication and sintering, stability in water, kinetics in water, UO_2–O_2 equilibrium and kinetics, diffusion studies, in-pile gas release, UO_2 dissolution rates, and nickel plating of UO_2 pellets for recoil experiments. The UO_2 irradiation test program is described, including steam oxidized MCW UO_2, hot pressed MCW UO_2, experiments with UO_2 rods containing 0.2 wt. % TiO_2, experimental irradiation of natural UO_2 rods, power cycling of PWR reference UO_2 fuel rods, density vs. fission product release in hot water, the second PWR bundle proof test, a statistical irradiation experiment, and defect tests on Chalk River UO_2. Contributions from Battelle Memorial Inst. ceramic studies, physical and electrical property investigation of uranium oxides, and kinetics of zirconium–uranium dioxide reactions are presented. A uranium dioxide panel report from Corning Glass Works concerning rupture tests on uranium dioxide compacts, sintering methods, and corrosion tests is presented along with a summary of the uranium dioxide program at MCW, and fit tolerance tests at Hanford. Contributions for the uranium dioxide Panel sponsored by WAPD concerning physical property, fabrication, and mechanical property data are presented along with a note on the melting point of uranium dioxide from work done at KAPL. (J.R.D.)

10511 WIN-76

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

ACID LEACH CCD–COLUMNS PILOT PLANT TESTING OF RIO DE ORO DYSART SHAFT ORE. W. A. Millsap and R. L. Shimmin. Nov. 1, 1957. Changed from OFFICIAL USE ONLY June 11, 1958. 36p. Contract AT(49-6)-924. $6.30(ph OTS); $3.00(mf OTS).

Rio de Oro Dysart Shaft ore from the Ambrosia Lake district of New Mexico was treated in the Acid Leach–CCD–Columns Pilot Plant at Grand Junction, Colorado. Detailed information is given on the liquid–solid separation by continuous counter-current decantation, ion exchange, and precipitation in connection with the processing of this ore. A section is included on mill design considerations. Results show the ore to be amenable to the Acid Leach–CCD–Ion Exchange Columns process. (auth)

10512 WIN-88

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

LABORATORY STUDIES IN CARBONATE ION EXCHANGE FOR URANIUM RECOVERY. E. T. Hollis. May 1, 1958. 52p. Contract AT(49-6)-924. $9.30(ph OTS); $3.60(mf OTS).

The results of laboratory studies on sodium carbonate ion exchange are shown. The effect of salt concentration, uranium concentration, and possible interference with ion exchange from vanadium, molybdenum, sulfate and chloride are discussed. Various elution systems and the effect of residual uranium are described. A short discussion of ammonium carbonate ion exchange is also presented. (auth)

10513 WIN-96

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

AMENABILITY TESTING OF ST. ANTHONY ORE. H. I. Viklund and E. J. Hammond. May 9, 1958. 13p. Contract AT(49-6)-924. $3.30(ph OTS); $2.40(mf OTS).

The results of laboratory amenability testing of an ore sample from the St. Anthony Uranium Corp., in Valencia County, N. Mex., are presented. (auth)

10514

IMPROVEMENT OF THE ALKALI DECOMPOSITION PROCESS OF MONAZITE. G. A. Meyerson, G. Ye. Kaplan, and T. A. Uspenskaya. Atomnaya Energiya 3, 259-60(1957).

A monazite concentrate, with a granulation of 1 to 5 mm, was treated with NaOH at a temperature of 130°C. The optimum length of leaching time was found to be 4 hours. It was found that the best results occurred if the quantity of NaOH used was 150 to 200% more than the weight of the concentrate. A two-step leaching procedure reduced the consumption of NaOH. In the first step 75% of the initial weight of the concentrate was used as the NaOH weight. The insoluble residue from this step was collected and treated with 150% of the weight of the residue. The NaOH from this second step was used for the first step of the next batch. (J.S.R.)

10515

ON THE SYSTEM BaF_2–UF_3. Z. G. Atomnaya Energiya 3, 562-3(1957).

By the aid of x-ray spectrographic and thermal analyses the phase diagram of BaF_2–UF_3 has been determined. Radiographic investigations showed that the lattice parameters of BaF_2, if 50 mole % UF_3 is dissolved in it, decrease from 6.189 + 0.005 kX to 6.035 + 0.005 kX. The parameters of the hexagonal UF_3 lattice are modified, if ~ 20 mole % BaF_2 is dissolved in it, from a = 4.131 kX and c = 7.335 kX to a = 4.197 kX and c = 7.359 kX. In densitometry the following data are present: 75% BaF_2 + 25% UF_3, ρ = 5.87 g/cm^3; 90% UF_3 + 10% BaF_2, ρ = 8.50 g/cm^3. (TCO)

10516

REACTION RATE AND ELECTRON TRANSFER MECHANISM IN DISPROPORTIONATION REACTION OF URANIUM (V). Hideo Imai (Hiroshima Univ.). Bull. Chem. Soc. Japan 30, 873-81(1957) Nov.

In acid solution, hexavalent uranium(UO_2^{2+}) is reduced to unstable quinquivalent uranium at the dropping mercury electrode, and is regenerated by the disproportionation reaction of the reductant as is schematically shown in the equations $U^{6+} + e \rightarrow U^{5+} \rightarrow U^{6+} + U^{4+}$: disproportionation reaction. (auth)

10517

SOME EXPERIMENTS ON ARTIFICIAL SYNTHESIS OF URANINITE. G. B. Naumov and K. I. Tobelko. Geo-

khimiya No. 4, 24-7(1956). (Translated from Referat. Zhur. Khim. No. 9, 1957, Abstract No. 30320.)

In a weakly alkaline medium, compounds of U^{4+}, analogous to the natural uranite, were obtained from compounds of U^{6+} at 150 to 200°. (J.S.R.)

10518

URANIUM DISTRIBUTION IN PSEUDOWOLLASTONITE SLAG. Edward Young (U. S. Geological Survey, Denver, Colo.) and Zalman S. Altschuler (U. S. Geological Survey, Washington). Ind. Eng. Chem. 50, 793-6(1958) May.

Production of elemental phosphorus from uraniferous phosphorite annually yields large quantities of uraniferous slag, mainly pseudowollastonite. Uranium distribution within such a slag was studied for potential by-product exploitation of uranium. The earliest crystals form a mesh of euhedral laths within which equant crystals, of slightly different composition, are deposited. Finally, poorly crystallized, fibrous material is deposited in the interstices. Iron phosphide spherules occur sparsely as inclusions. Analyses and nuclear emulsion studies show that uranium is not uniformly distributed within the slag but concentrates in the later crystal products and the spherules. Beneficiation possibilities are revealed in segregation of the later phases by heavy liquids. Suggestions are made for possible increase in production of uranium-rich phases as a means of concentrating many tons of recoverable uranium. (auth)

10519

THE FLUORIDES OF URANIUM. I. LIQUID-VAPOUR EQUILIBRIA IN THE SYSTEMS URANIUM HEXAFLUORIDE-CHLORINE TRIFLUORIDE AND URANIUM HEXAFLUORIDE-BROMINE PENTAFLUORIDE. J. F. Ellis and K. D. B. Johnson (United Kingdom Atomic Energy Authority, Industrial Group, Capenhurst Works, Chester, Eng.). J. Inorg. & Nuclear Chem. 6, 194-8 (1958) June.

The system uranium hexafluoride-chlorine trifluoride exhibits complete miscibility in the liquid phase at 67°C but partial miscibility at 75°C over a limited composition range. No azeotropes exist in this system. The system uranium hexafluoride-bromine pentafluoride exhibits complete miscibility over the range 68 to 80°C and has a single maximum vapor pressure azeotrope at a composition corresponding to a mole fraction of 0.1 of uranium hexafluoride, approximately. (auth)

10520

THE FLUORIDES OF URANIUM. II. DISTILLATION OF MIXTURES OF CORROSIVE VOLATILE FLUORIDES INCLUDING URANIUM HEXAFLUORIDE. J. F. Ellis, L. H. Brooks, and K. D. B. Johnson (United Kingdom Atomic Energy Authority, Industrial Group, Capenhurst Works, Chester, Eng.). J. Inorg. & Nuclear Chem. 6, 199-206(1958) June.

Distillation of binary systems has shown that uranium hexafluoride is completely separable from chlorine trifluoride and bromine trifluoride, but forms azeotropes with hydrogen fluoride and bromine pentafluoride. At pressures above atmospheric, uranium hexafluoride and bromine interdistil without separation. Hydrogen fluoride forms azeotropes with bromine, bromine trifluoride, bromine pentafluoride and chlorine trifluoride. A distillation method has been evolved for purifying uranium hexafluoride from a ternary mixture with chlorine trifluoride and hydrogen fluoride. (auth)

10521

DETERMINATION OF URANIUM IN THE ASH OF DOMESTIC COAL. II. DETERMINATION OF URANIUM IN COAL ASH WITH MORIN. Gyula Almassy and Csaba Ujhelyi. Magyar Tud. Akad. Kem. Tud. Oszt. Kozl. 8, No. 1, 47-51(1956). (Translated from Referat. Zhur. Khim. No. 9, 1957, abstract no. 30999.)

The previously developed method of determining U with morin has been applied in the analysis of coal ash. Fe^{3+} (in the presence of complexone III), and also small amounts of V and Mo do not interfere. In the analysis the sample is treated with nitric acid and extracted with ether. The ether is driven off, and in the aqueous solution U is determined photometrically by means of morin. The results obtained are in agreement with results of radiometric determinations. 30 to 250γ U are determined with a U content of 0.0003% in the ash.

Waste Disposal

10522 CF-58-3-109

Oak Ridge National Lab., Tenn.

DISPERSION OF SOLUBLE RADIOACTIVE MATERIAL IN WATER. Fred S. Dunning and John C. LeDoux. Mar. 20, 1958. 36p. Contract [W-7405-eng-26]. $6.30 (ph OTS); $3.00(mf OTS).

Theories of diffusion processes in water are discussed and the dispersion of radioactivity is calculated from an interpretation of the molecular diffusion equation with modifications which tend to fit the equation to experimental data. From this the dose rate resulting from fission products in solution are made for a number of situations of interest. Parametric solutions are obtained and plotted on graphs which may be used to obtain water concentrations and thence dose levels. (auth)

10523 CF-58-4-45

Oak Ridge National Lab., Tenn.

MANUAL FOR THE PREPARATION OF SIMULATED FUEL REPROCESSING WASTE SOLUTION. William J. Lacy. June 20, 1958. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Preparation of synthetic wastes from the processing of aluminum-clad natural uranium, aluminum-enriched uranium alloy, zirconium-uranium, stainless steel-UO_2, and stainless steel-UO_2-MgO fuel elements is described. These preparations will be used in waste disposal studies. (auth)

10524 WAPD-CDA(AD)-383

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]

BATCH TREATMENT PROCEDURE FOR WASTES CONTAINING CHROMATE AT INHIBITOR CONCENTRATIONS. R. Lloyd. [1957]. 26p. [Contract AT-11-1-GEN-14.] $4.80(ph OTS); $2.70(mf OTS).

A study was made of the parameters involved in the reduction-flocculation procedure for treating chromate-bearing wastes and optimum parameters were established for batch treatment of wastes containing as high as 1000 ppm chromate ion as potassium chromate effecting a reduction of CrO_4^{2-} to 0.05 ppm and Cr^{3+} to 1.0 ppm. A detailed waste treatment procedure was outlined, which is applicable over the entire range of chromate concentration in the chromate-inhibited systems of the PWR plant at Shippingport. (auth)

10525

CHARACTERISTICS OF REACTOR FUEL PROCESS WASTES. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 44, Session 16. J. O. Blomeke, E. D. Arnold, and A. T. Gresky (Oak Ridge National Lab., Tenn.). New York, American Institute of Chemical Engineers, 1958. 14p.

The various types or high-level radioactive liquid wastes currently produced as effluents from reactor fuel processing plants are reviewed. Wastes expected from processes under development for power reactor fuels are also discussed. The wastes are characterized according to their chemical compositions, physical properties, and fission product activity levels. (auth)

10526

EFFECTS OF URANIUM ORE REFINERY WASTES ON RECEIVING WATERS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 40, Session 18. E. C. Tsivoglou, A. F. Bartsch, D. E. Rushing, and D. A. Holaday (U. S. Public Health Service). New York, American Institute of Chemical Engineers, 1958. 32p.

In addition to uranium, ores contain 12 radioactive decay products of uranium, among which are several long-lived alpha emitters such as radium. These daughters of uranium are all waste products of the ore refining industry. At present rates of uranium processing, for example, some 2,500 grams of waste radium are produced annually. Several stream surveys have been made in the vicinity of American uranium mills, and the results of these surveys are reported herein. They have indicated varying degrees of stream contamination below the mills, depending upon local mill processes, capacity, stream flow history, and waste disposal practice. Particular attention has been given to the accumulation of radioactivity, specifically radium, in the stream biota and sediments. The extent of the problem is discussed, as well as its immediate and long term public health significance. (auth)

10527

THE ADSORPTION OF RADIOACTIVE SUBSTANCES ON WATERBORNE AND CONSOLIDATED MATERIALS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 11, Session 35. F. B. Barker (U. S. Geological Survey, Denver). New York, American Institute of Chemical Engineers, 1958. 25p.

Adsorption is a phenomenon that has a direct bearing on the transport and distribution of radioactive substances in surface and ground water. The rate of adsorption of radioactive substances and the quantity adsorbed are related to the composition of contaminants in the liquid form, to the chemical quality of the natural water involved, and to the minerals present and their ion-exchange capacity. Preliminary results of some studies of this type are discussed. (auth)

ENGINEERING

10528 AERE-ED/R-1672

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE STATIC STRENGTH OF PRESSURE FED GAS JOURNAL BEARINGS; POROUS BEARINGS. Cyril H. Robinson and Frank Sterry. Dec. 1957. 69p. $1.80 (BIS).

The method of operation of an hydrostatic journal bearing is reviewed. An expression for the load carried and the gas flow from an infinitely long porous bearing is deduced, and experimental results are plotted on the basis of parameters derived from the theoretical study. Design curves for load and gas flow are included. (auth)

10529 HW-55178

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FABRICATION OF GLASS BEARINGS. B. B. Brenden. Apr. 9, 1958. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Sleeve bearings made of Pyrex Brand #7740 glass are used in multiple-stage turbine pumps to pump uranyl nitrate hexahydrate (UNH) solutions. The glass bearings replace pile graphite bearings and boron carbide bearings. At present the glass bearings cost approximately $70 apiece, but have been shown to last about 30 times as long as the pile graphite bearings. Boron carbide bearings are difficult to make and do more damage to the pump when they fail. (auth)

10530 AEC-tr-3230

NEW HIGH-EFFICIENCY HIGH-PRESSURE CENTRIFUGAL FANS FOR MINES. V. S. Pak and V. D. Semenenko. Translated from Dopovidi Akad. Nauk Ukr. R.S.R., No. 1, 41-4(1958). 5p.

10531

REINFORCEMENT OF OPENINGS IN PRESSURE VESSELS. E. O. Waters (Yale Univ., New Haven, Conn.). Welding J. (N. Y.) 37, 277s-88s(1958) June.

A short account of some of the developments in the field, emphasizing those that have occurred since 1930, is given. What has been done is reviewed and the gaps which the Pressure Vessel Research Committee is attempting to fill are pointed out. (A.C.)

Heat Transfer and Fluid Flow

Refer also to abstract 11199.

10532 AECU-3698

Atomic Power Development Associates, Inc., Detroit.

SODIUM BOILING CALCULATIONS. R. B. Nicholson. July 2, 1957. 7p. $1.80(ph OTS); $1.80(mf OTS).

The equations are derived for making rough calculations of the pressure drop required to produce a given mass flow through a subassembly for a given heat generation for cases where the vapor volume fraction is 0.9 or less. The ratio of vapor velocity to liquid velocity is left as a parameter that is varied from unreasonably low to unreasonably high values. (T.R.H.)

10533 AECU-3699

Atomic Power Development Associates, Inc., Detroit.

SODIUM BOILING—EXPLANATION OF SECTION IV.4 OF MY JULY 2, 1957 MEMORANDUM ON "SODIUM BOILING CALCULATIONS." R. B. Nicholson. Oct. 1, 1957. 4p. $1.80(ph OTS); $1.80(mf OTS).

10534 AECU-3700

[Atomic Power Development Associates, Inc., Detroit.]

OPERATING EXPERIENCE AND RESULTS OF TESTING THE FIRST APDA PROTOTYPE LIQUID METAL ONCE-THROUGH STEAM GENERATOR. R. H. Jones, T. E. Lempges, H. J. Williams, and J. Wooton. Dec. 1957. 67p. [Contract AT(11-1)-476]. $10.80(ph OTS); $3.90(mf OTS).

To aid in the development of a once-through steam generator to be used in a sodium-cooled nuclear reactor plant, a small-scale prototype model of the contemplated steam generator was fabricated and subjected to various testing programs. The prototype once-through steam generator, which consists of 7 full-length, ½-in. O.D. × 0.050-in. wall, single-wall tubes, was tested for a period of about 1 year to determine its steady-state characteristics and its transient be-

havior. One year of operation of the unit indicates the once-through steam generator to be entirely satisfactory. It has been subjected to, and successfully withstood, cycling conditions equivalent to a number of years of normal operation. It is interesting to note that, of the 25 unscheduled shut-downs that occurred during the year, none were the result of failure of liquid metal components or the once-through steam generator. The single-wall tube design was found to be entirely satisfactory. (auth)

10535 CF-58-4-56
Oak Ridge National Lab., Tenn.
A PRELIMINARY STUDY OF BOILING BURNOUT HEAT FLUXES FOR WATER IN VORTEX FLOW. W. R. Gambill and N. D. Greene. Apr. 12, 1958. 37p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

A study was made of burnout heat fluxes associated with forced-convection source-vortex flow of subcooled water. The maximum heat flux experimentally attained was 35.1×10^6 Btu/hr · ft^2 (11.1 kw/cm^2). Vortex flow and straight flow heat-transfer rates have been compared. (auth)

10536 GAT-DM-685
Goodyear Atomic Corp., Portsmouth, Ohio.
FLOW NOZZLE CALIBRATION. C. P. Work. June 17, 1958. 6p. Contract [AT(33-2)-1]. $1.80(ph OTS); $1.80(mf OTS).

A flow nozzle calibration makes it possible to determine accurate constants which can be used in a quick and simple method for determining mass rate of flow in a test loop. A program was developed for the IBM computer to perform the necessary calculations. The program consists of two parts: calculations of gas velocities, at pre-selected points in the flow nozzle, from pressure measurements, and calculation of the flow nozzle constants by performing a numerical integration of the velocity profile to obtain an average velocity and using this average to calculate the constants. The program will duplicate results obtained by a combination of other methods. Use of the program will save several hours of an engineer's time in plotting and integrating to determine the flow nozzle constant. More frequent calibrations can be made since the analysis is strictly mechanical. (auth)

10537 KAPL-1844
Knolls Atomic Power Lab., Schenectady, N. Y.
INVESTIGATION OF DUPLEX TUBES. E. Y. Stewart. Aug. 23, 1957. Decl. April 9, 1958. 30p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

When the two-tube (duplex) test steam generator was retubed, only limited information pertaining to the heat transfer characteristics of duplex tubes was available and the fabrication procedures in their manufacture to obtain maximum heat transfer had not been fully developed. Since a $1/11$ scale model and three prototype steam generators were to be built with duplex tubes for the S1G/S2G Project, an investigational program was initiated to provide this information as quickly as possible. The investigation consisted of a review of the state of the art through a literature survey, a detailed analysis of the transfer of heat through duplex tubes, application of the information obtained to the production of duplex tubes for tests, and a backup duplex tube program. As a result of the investigation a general fabrication procedure for producing efficient duplex tubes in steam generators heated by liquid metal was recommended. (auth)

10538 NACA-TN-4186
Johns Hopkins Univ., Baltimore and Ballistic Research Labs., Aberdeen Proving Ground, Md.
HEAT TRANSFER IN ISOTROPIC TURBULENCE DURING THE FINAL PERIOD OF DECAY. D. W. Dunn and W. H. Reid. June 1958. 68p.

The problem of heat transfer in isotropic turbulence with a constant mean temperature gradient is considered during the final period of decay. The Reynolds and Péclet numbers are then very small, and all triple correlation terms can be neglected in the equations for the double correlations. On this basis it is found that the temperature field ultimately becomes independent of the initial conditions on the temperature and has characteristics determined only by the mean temperature gradient, the physical properties of the fluid, and the characteristics of the turbulence. Detailed analytical and numerical results are obtained for the asymptotic state. (auth)

10539 NACA-TN-4311
Lewis Flight Propulsion Lab., Cleveland.
PRANDTL NUMBER EFFECTS ON UNSTEADY FORCED-CONVECTION HEAT TRANSFER. E. M. Sparrow and J. L. Gregg. June 1958. 14p.

An analysis is made for laminar forced-convection heat transfer on a flat plate with unsteady surface temperature. The deviation of the instantaneous heat-transfer rate from the quasi-steady value is computed. Results are obtained for Prandtl numbers in the range 0.01 to 10. The deviations from quasi-steady heat transfer increase markedly with increasing Prandtl number. The findings should apply approximately in the entrance region of ducts and should also provide an upper bound on deviations from turbulent quasi-steady heat transfer. (auth)

10540 NP-6728
Illinois. Univ., Urbana. Engineering Experiment Station.
POINT SOURCE TURBULENT DIFFUSION FOR AN AIR FLOW IN A DUCT. Technical Report No. 6 [on] EXPLORATION AND APPLICATION OF TURBULENCE THEORY. Thomas J. Hanratty and Duane L. Flint. Jan. 1958. 106p. DA Project 5B99-01-004. Contract DA-11-022-ORD-1707.

The turbulent diffusion process was examined by injecting hydrogen at the center of a three inch pipe into turbulently flowing air and by taking concentration traverses at distances downstream. The air velocity in the pipe was varied to determine how the diffusion rate varied over a Reynolds' number range of from 9,700 to 87,000. The role of molecular diffusion on the turbulent diffusion process was examined by duplicating one of the runs using hydrogen which has a relatively high molecular diffusivity with a run using carbon dioxide with a low molecular diffusivity as the tracer gas. The results of the investigation indicate that the turbulent diffusion rate is a linear function of the Reynolds' number in the range studied. The role of molecular diffusion was found to account for about 7% of the total diffusion at a Reynolds' number of 72,000. As a first approximation it was determined that the total mean squared displacement was equal to the mean squared displacement due to turbulent effects alone as predicted by Taylor's theory plus the mean squared displacement due to molecular motion. The velocity and temperature profile equations gave good qualitative descriptions of turbulent diffusion processes. (auth)

10541 WAPD-T-588
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
NUCLEATE BOILING DETECTION TECHNIQUES.

K. Katz, Richard T. Esper, and Walter E. Hopkins, Jr. [1957]. 25p. [Contract AT-11-1-GEN-14.] $4.80 (ph OTS); $2.70(mf OTS).

Several non-visual methods used for the detection of steady-state local boiling are discussed in detail. In addition, an audio detection technique which appears technically feasible but has not been fully developed, is described briefly. (W.D.M.)

10542 WAPD-TH-307(Del.)

Westinghouse Electric Co. Bettis Plant, Pittsburgh. RESULTS OF VELOCITY DISTRIBUTION AND MIXING TESTS IN AN AIR FLOW MODEL OF FIRST PASS EXTENSION REGION. W. H. Bell and B. W. LeTourneau. Apr. 12, 1957. 29p. $4.80(ph OTS); $2.70(mf OTS).

A wood and masonite mockup of the first pass seed plate-type subassembly and extension region was constructed and tested in the Bettis Large Air Loop, No. 28. Descriptions of the test facility and test section model and instrumentation are given. The results of these tests indicated that: (1) Due to the upper extension bracket clamping bolt receptacle, the minimum average channel velocity was 5% below the average velocity in the subassembly. (2) The ratio of maximum-to-average velocity in the upper extension bracket region was about 1.40, where the average velocity was taken over the total subassembly cross section excluding the clamping bolt receptacle. (3) Some recirculation occurred in the interpass exension region of the model. (4) The mixing that occurred in the upper extension bracket was so slight that the number of thermocouples required to sense an average temperature of the effluent from a subassembly would be prohibitively large. (M.H.R.)

10543 WAPD-TM-8

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. RADIANT HEAT FLOW EXPERIMENT ON IN-PILE CRYOSTAT MOCK-UP. M. L. Bleiberg. Dec. 15, 1956. 14p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

In the design of an in-pile cryostat for studying the kinetics of phase changes of U alloys it was found necessary to lower the radiant heat loss of the cryostat. A 12-in. mock-up of the outer portion of the cryostat was made, radiant heat flow was measured by calorimetric methods, and the effects of a radiant heat shield and bright etching of the Al parts were determined. The data show a radiant heat loss reduction of 48% due to the shield and an additional 12% for the etching. (T.R.H.)

10544

A FLOW METER WITH RADIOACTIVE FLOAT. N. S. Korshunov and M. V. Khatskevich. Atomnaya Energiya 3, 250-2(1957).

The construction of a flow meter is described in which a Co^{60} source (2 to 5 mc) is fitted on the float of the rotating indicator. The position of the float as a measure of the quantity of the flow is represented by the recordings of an ionization chamber. By means of two trial series the consumption of carbon tetrachloride under laboratory conditions within the range of from 0.015 to 0.06 l/h and the water consumption within the range of from 0.2 to 2 l/h could be measured with an accuracy of ±2.5%. (TCO)

10545

CHART VISUALIZES HEAT TRANSFER RELATIONS. Edward J. Gibbons. Chem. Eng. 65, No. 11, 129-30 (1958) June 2.

A chart which visualizes the relations between heat transferred, area, transfer coefficient, and temperature difference is presented. (auth)

10546

STEADY-STATE LONGITUDINAL AND RADIAL TEMPERATURE DISTRIBUTIONS IN INTERNALLY HEATED FINITE WIRES. George W. Preckshot (Univ. of Minnesota, Minneapolis) and John W. Gorman (Standard Oil Co. of Indiana, Whiting). Ind. Eng. Chem. 50, 837-48 (1958) May.

The differential equation for the steady-state simultaneous longitudinal and radial temperature distributions in electrically heated finite cylinders with ends at the ambient temperature has been set up and solved for variable Q and constant h and k. The effect of variable h on the longitudinal gradient is shown for variable Q and constant k. Radial temperature gradients were computed under several assumptions. Example calculations are presented for comparison. A method of selecting a desirable test section length for predetermined mid-cylinder and test length end temperatures is given. A method is given for estimating the mid-length temperature from a measured mean temperature and operating conditions. (auth)

10547

MEASURING GAS FLOW BY IONIZATION METHODS. L. V. Mel'tser. Izmeritelnaya Tekh. No. 5, 43-7(1957) Sept.-Oct.

The general methods of measuring gas flow by electrical discharge or radioactivity are reviewed. The method of "marked molecules," developed at the Institute for Automatics and Telemechanics, is described. The advantages of the method are cited. (J.S.R.)

10548

HEAT EXTRACTION IN POWER REACTORS. 1. G. Boxer (Birmingham Coll. of Tech., Eng.). Nuclear Power 3, 266-71(1958) June.

A recapitulation of the laws of steady flow heat transfer by conduction and convection is presented. (W.D.M.)

10549

THEORY OF GAS FLOW IN A POROUS BODY NEAR THE KNUDSEN REGION. PSEUDOMOLECULAR FLOW. B. V. Dervagin and S. P. Bakanov (Inst. of Physical Chemistry, Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 326-31(1957) July-Aug.

The gas flow in the pseudomolecular region and in the transition region to Knudsen flow is considered where $D \ll \lambda_g$, D is the mean particle size, and λ_g is the ordinary mean free path of gas molecules at a given pressure. The filtration coefficient is derived, and it is plotted as a function of the porosity and intermolecular collisions. The curves show a definite minimum. At high pressures the flow is directly proportional to the pressure. (J.S.R.)

10550

FREE CONVECTION HEAT TRANSFER TO WATER AND MERCURY IN AN ENCLOSED CYLINDRICAL TUBE. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 27, Session 20. J. P. Hartnett, W. E. Welsh, Jr., and F. W. Larsen (Univ. of Minnesota, Minneapolis). New York, American Institute of Chemical Engineers, 1958. 22p.

Local free convection heat transfer results are reported for water and mercury in a cylindrical vertical tube closed at the bottom with uniform heat flux into the side walls and connecting at the top into a large reservoir. The system was found to be inherently quasi-steady with the temperature oscillations much more pronounced with mercury as the working fluid. Experimental data were also obtained with the tube inclined

30° from the vertical position and the resulting heat transfer performance was found to be significantly increased above that obtained with the vertical tube. (auth)

Materials Testing

10551 EES-040069C

Naval Engineering Experiment Station, Annapolis.
TEST OF 3,000 PSI MECHANICAL TYPE FITTINGS WITH TUBES OF VARIOUS ALLOYS. J. S. Whelan and W. L. Williams. June 7, 1957. 22p.

Experiments are reported on three commercial designs of mechanical fittings for 3,000 psi service. The tests were made on fittings for ¼" and 1" OD tubing. The tube alloys included Types 304 and 316 stainless steel, 70-30 and 90-10 copper-nickel alloys, and 6061-T6 aluminum alloy. The experiments included hydrostatic, tension, hydraulic shock, mechanical shock, fatigue, and make-break tests. Performance was found to depend on both fitting design and tube alloy. Only one of the fittings appeared outstanding for use with all tube alloys. (auth)

10552 NRL-5138

Naval Research Lab., Washington, D. C.
A HIGH TEMPERATURE VACUUM AND CONTROLLED ENVIRONMENT FATIGUE TESTER. G. J. Danek, Jr. and M. R. Achter. Mar. 31, 1958. 13p. Projects NR-510-000 and NA-585-001.

Equipment was developed for reverse-bending fatigue tests at elevated temperatures in vacuum. Large strain amplitudes at low frequencies are used to produce failures in approximately 10^5 cycles. A major problem in the design of such equipment, the transmission of motion through a vacuum seal, was circumvented by the use of a magnetic coupling driven at the resonant frequency of the specimen. Two methods of vibrating the specimen were developed. One arrangement uses two oscillating permanent magnets outside the vacuum chamber, while the other employs two electromagnets excited alternately. Provision was made for automatically stopping the test with a thyratron circuit when a crack has developed. Fatigue data were gathered for type 316 stainless steel in a vacuum of 3×10^{-5} mm of mercury through a range of stresses at 1500°F. (auth)

10553 SCR-15

Sandia Corp., Albuquerque, N. Mex.
A FACILITY FOR THE STUDY OF THE EFFECTS OF NUCLEAR RADIATION ON MATERIALS. John L. Colp and A. William Snyder. June 1958. 23p. Contract AT-(29-1)-789. $0.75(OTS).

The Sandia Engineering Reactor Facility consists of a 5-Mw light water moderated heterogeneous-type nuclear reactor, a large dry irradiation room and the necessary laboratory space for the preparation and post-irradiation testing of material samples. This Facility will be used to study the effects of radiation on the engineering properties of materials. Equipment for producing additional environments of heat, cold, altitude and vibration will be available for compounding with the radiation environment during material tests. An interesting feature of the operating concept for this facility is the plan to operate the reactor on a continuous, 24-hour per day, seven-day per week basis except for required reactor shut downs. This feature means that provisions must be made in the design of the facility to provide for the remote insertion and removal of test objects during full power reactor operation. Instead of having several heavily shielded individual "hot cells," this facility has one large "hot area." This "hot area" is separated from the remainder of the Facility by a 42-inch-thick concrete shielding wall containing six high-density lead glass windows, each equipped with a pair of Argonne Model 8 manipulators. Materials for post-irradiation testing and analysis are brought to each window by means of a specially designed Mobile Remote Handler. This Handler is a mobile, electrically driven vehicle containing one man shielded by approximately 6½ in. of lead. (auth)

10554 WAPD-TM-113

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
RADIOCHEMISTRY OF FIFTH PWR FUEL MATERIAL TEST (X-1-f) X-1 LOOP NRX REACTOR. R. Ehrenreich, P. W. Frank, and K. H. Vogel. Mar. 1958. 53p. Contract AT-11-1-GEN-14. $1.50(OTS).

The Fifth PWR Fuel Material Test (X-1-f) was conducted in the NRX Reactor as one of a series of in-pile irradiation tests of PWR fuel materials with special emphasis on the chemical and radiochemical conditions of the coolant. This test was to study the effects of large clearances between the fuel material and cladding on fission product release and on fuel behavior. Three of the five specimens were predefected. Irradiation commenced on February 16, 1956 and was terminated on March 20, 1956. The test was run under PWR conditions of temperature and pressure but at neutral pH. Evidences of pellet center melting were observed. The distribution of activity in loop water, purification resins, and on pipe walls was established. Decontamination factors for MB-1 resin were determined for the gross soluble activity and specific radionuclides. Escape rate coefficients relating the leakage rate of radioisotopes from the defected element to their concentration in the fuel were calculated for various nuclides. The mechanism of fission product escape from failed elements and its distribution in the system is discussed. After the test a gamma survey of the loop was made, and the activity decay was followed for a period of 25 days. A comparison of test parameters, specimens, and general activities of all evaluated defect tests is presented. (auth)

Pumps

10555 CF-58-5-80

Oak Ridge National Lab., Tenn.
PUMP-MOTOR MIXING AND HEAT BALANCE TESTS OF THE BYRON-JACKSON 4000-GPM PUMP. H. R. Payne. May 16, 1958. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The pump-to-motor mixing rate of the Byron-Jackson 4000-gpm pump was determined as a function of motor purge flow. A purge rate of 63 liters/hr, which corresponds to a mixing rate of 0.55 liters/hr, is recommended for operation of this pump. Further increases in purge flow did not decrease the mixing rate significantly below this level. Two runs were made with cooling water bypassing the external motor cooler. These runs indicated that the external cooler was necessary to prevent overheating of the 4000 gpm pump motor. However, the observed heat balance checked the predicted heat balance, indicating that the method of prediction can be applied to the design of motor cooling in other large pumps. (auth)

10556 CF-58-5-81

Oak Ridge National Lab., Tenn.
ELECTRICAL SIMULATION OF DIAPHRAGM FEED PUMP SYSTEM. P. F. Pasqua. May 22, 1958. 9p.

Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The electrical analog study of the diaphragm feed pump system resulted in changes to the system which have improved the over-all operation and reliability of the pumps. Specifically, the study showed that if the release of the high-pressure oil from the pulsator through the valve on the Scott and Williams pump could be made to take place over a longer period of time, pressure oscillations could be substantially reduced. Also, pressure surges could be reduced by placing an accumulator in the pump discharge line near the check valve. Both of these ideas have been incorporated into the experimental test equipment which has resulted in a quieter and smoother operation of the pumping system. (auth)

Radiography

10557

CESIUM-137 AS A VERSATILE RADIOGRAPHIC TOOL. Merle Rhoten (Battelle Memorial Inst., Columbus, Ohio). J. Soc. Non-Destructive Testing 16, 261-4(1958) May-June.

Cesium-137 is adequate for use in a foundry or manufacturing organization requiring 10 or less radiographic films per day; supplanting x-ray machines. Cesium-137 also provides a source that will cover the most widely used range of thickness, and it is of use in laboratories by extending the range of a 250 kvp x-ray, and by filling in the gap between this machine and a cobalt-60 source. (J.R.D.)

10558

GAMMA RADIOGRAPHY OF LIGHT METALS. Eric T. Clarke (Technical Operations, Inc., Burlington, Mass.). J. Soc. Non-Destructive Testing 16, 265-8(1958) May-June.

Characteristics of the two most promising soft gamma ray emitters thulium-170 and iridium-192 are presented. Seventy-five day Ir^{192}, with an effective energy of 400 kev, can be produced in $\frac{1}{8}'' \times \frac{1}{8}''$ iridium metal pellets in strengths up to 30 Rhm, or in $\frac{1}{16}'' \times \frac{1}{16}''$ sizes up to 8 Rhm. Two per cent radiography is achievable in thicknesses greater than about 2" aluminum or 3" magnesium. Typical exposure time is $\frac{1}{2}$ minute for the larger source at 12" from the medium speed film with lead screens. Thulium-170, which decays with a 4 month half life, emits radiation chiefly at 52 and 84 kev. Two per cent radiography can be obtained with this isotope on 0.030" steel, $\frac{1}{2}$" aluminum, or $\frac{3}{4}$" magnesium. Exposure times, however, are long because practical source strengths are in the neighborhood of 0.1–0.2 Rhm for $\frac{1}{8}'' \times \frac{1}{8}''$ sizes (considerable self-absorption of the radiation limits the maximum intensities available). Medium speed film requires $\frac{1}{2}$ hour exposure to such large sources at 12" distance, though this can be reduced to $\frac{1}{3}$ minute if the graininess of Kodak Type F with Hi-Speed Patterson screens can be tolerated. (auth)

10559

THE USE OF GAMMA-DEFECTOSCOPY IN MACHINE CONSTRUCTION. A. V. Barilenko. Vestnik Elektroprom. 28, No. 12, 55-8(1957).

The use of gamma radiation for radiographic inspection in the Soviet Union is briefly reviewed. Co^{60} is the chief isotope used, but Ir^{192} is also widely used. Other isotopes are being investigated. The general technique of gamma radiography is described, and the equipment being used is illustrated. (J.S.R.)

Tracer Applications

10560

THE USE OF RADIOACTIVE ISOTOPES IN MEASURING THE PRESSURE OF SATURATED STEAM. An. N. Nesmeyanov. Atomnaya Energiya 3, 227-37(1957).

Various methods of measuring the pressure of saturated steam are described and compared with the isotopic exchange method. This method has a sensitivity as good or better than the other methods. (J.S.R.)

Vacuum Systems

10561

ENRICHMENT OF A JET OF VAPOR ENTERING A VACUUM. V. D. Burlakov. Atomnaya Energiya 3, 257-9(1957).

It is known that in the purification of metals by vacuum distillation, the condensate is enriched by oxygen and nitrogen residual gas. The amount of enrichment was measured with a new apparatus. Mercury was vaporized and Hg^{203} vapor was used as the residual gas. The surface of the condensate was covered with a layer of the residual gas, confirming the theory of gaseous enrichment. (J.S.R.)

10562

VACUUM TECHNIQUES IN THE ATOMIC ENERGY INDUSTRY. H. Kronberger (U.K.A.E.A., Industrial Group Headquarters, Risley, Eng.). J. Brit. Nuclear Energy Conf. 3, 136-55(1958) Apr.

Examples are given showing how vacuum techniques are used in the uranium-235 diffusion plant, in plants handling liquid metals at high temperature, in experimental work for pressurized water reactors, and in the testing of the Calder Hall heat exchangers. The success of vacuum techniques in large-scale applications depends on three factors: correct design of plants, the availability of simple and reliable testing methods, and efficient managerial control of construction and test work. Basic design rules are given and illustrated by examples of flanges, valves and other components used. Vacuum testing methods are discussed. The charcoal–Pirani technique of testing is favored for most applications; tests can be carried out on components before they are degassed and "clean"; equipment and operation are simple. The management of vacuum work is discussed and a method of quality control by means of binomial distribution charts is described which has been useful in improving systematically the vacuum tightness of manufactured components. (auth)

10563

VACUUM WELDING BY ELECTROM BEAM. J. A. Stohr (Commissariat a l'Energie Atomique France). Nuclear Power 3, 272-4(1958) June.

An electronic beam welding machine has been built for circular welds in fuel element canning. It consists of a horizontal cylinder stainless steel chamber with observation ports, connected to a high vacuum system. The tungsten filament electron gun projects into the chamber at the top and has both fine and coarse positional adjustments. The workpiece, positioned directly below the gun, is rotated in a mandrel or chuck-driven by a thyratron-controlled, variable-speed motor and the whole assembly can be vertically adjusted by another motor driving through a rack-and-pinion gear. (W.D.M.)

Waste Disposal

10564
DISPOSAL OF LONG-LIVED FISSION PRODUCTS. J. R. Grover (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Brit. Nuclear Energy Conf. 3, 80-5(1958) Jan.

A process for the permanent fixation of fission product Sr^{90} and Cs^{137} is described. The highly active ions are adsorbed on granulated montmorillonite clay and fixed by firing the clay to 1200°C. Details are given of a remotely controlled experimental pilot plant to test the process. (auth)

10565
GEOLOGIC AND HYDROLOGIC GUIDES TO THE GROUND CONTAINMENT AND CONTROL OF WASTES AT HANFORD. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 14, Session 16. R. E. Brown and W. H. Bierschenk (General Electric Co., Richland, Wash.). New York, American Institute of Chemical Engineers, 1958. 12p.

Safe, economical, near-surface ground containment of waste radioisotopes at Hanford is achieved through correlation of data from many laboratory and field tests to extensive empirical data. The combined information additionally defines significant geologic and hydrologic features and suggests the potential and problems of waste confinement at greater depths. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

Ceramics and Refractories

10566 HW-51825
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CERAMICS LABORATORY CERAMIC FUEL DEVELOPMENT OPERATION. R. J. Anicetti and W. E. Roake. Aug. 5, 1957. 10p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A brief description is given of the present facility, scope, and program of the Ceramic Fuel Development Operation. (W.L.H.)

10567 ISC-910
Ames Lab., Ames, Iowa.
EFFECT OF CALCIUM FLUORIDE ADDITIONS ON THE SINTERING OF MAGNESIUM OXIDE. F. Wayne Calderwood and Dave Wilder. July 1957. 55p. Contract W-7405-eng-82. $1.50(OTS).

The effect of additions of calcium fluoride on the sintering of a refractory grade magnesium oxide fired under reducing conditions was studied. Specimens were formed at very low pressures to simulate compaction achieved in the jolt-pack technique, and at higher pressures commonly encountered in powder-pressing of ware. Specimens were fired in an induction furnace and held for pre-determined periods at temperatures ranging from 1300 to 1900°C. Shrinkage, bulk density, and grain growth factor were determined and presented as a function of composition and temperature. Specimens formed with the minimum compaction were found to increase in shrinkage and density with increase of calcium fluoride additive, no maxima occurring over the range 0% to 12 mole %. Specimens formed at higher pressures were found to have maximum density, shrinkage and grain growth when four mole-percent calcium fluoride was added. With larger amounts of this additive, bloating occurred, counteracting the sintering forces that tend to consolidate the mass. This mechansim is believed to be a liquid phase formed above a binary eutectic temperature, rather than a solid state reaction. No solid solution or compound formation was found to exist. (auth)

10568 KAPL-1918
Knolls Atomic Power Lab., Schenectady, N. Y.
PROPERTIES OF URANIA-CERIA BODIES FOR NUCLEAR FUEL APPLICATION. G. L. Ploetz, A. T. Muccigrosso, and C. W. Krystyniak. Jan. 1958. 23p. Contract W-31-109-Eng-52. $0.75(OTS).

Several compositions within the UO_2-CeO_2 system were studied for possible application as ceramic fuel in nuclear reactors. The properties of interest reported include density, porosity, modulus of rupture, thermal expansion, thermal conductivity, corrosion resistance to water, and microstructure. It was found that higher strength bodies resulted by air firing $U_3O_8-CeO_2$ mixtures into a single-phase solid solution rather than by hydrogen firing UO_2-CeO_2 mixtures into a single-phase solid solution. The preferred setting material for sintering low density urania-ceria bodies is BeO. For high-density bodies fired at temperatures above 1600°C, rhodium is a satisfactory refractory setting material. (auth)

10569 LAMS-2108
Los Alamos Scientific Lab., N. Mex.
FABRICATION OF LITHIUM HYDRIDE BY HOT-PRESSING. D. H. Schell, J. M. Taub, and D. T. Doll. June 1, 1955. 24p. Contract W-7405-eng-36. $0.75 (OTS).

Lithium hydride can be fabricated into shapes by hot-pressing the powders in iron-plated graphite dies at 1000 to 1500 psi and 600 to 620°C. A purity of 95% or better can be maintained and densities that are 98% or better of theoretical obtained. (auth)

10570 NAA-SR-2458
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
CREEP OF POLYCRYSTALLINE BeO AT HIGH TEMPERATURES AND LOW STRESSES. Roger Chang. May 1, 1958. 24p. Contract AT-11-1-GEN-8. $0.75 (OTS).

The tensile creep properties of polycrystalline BeO, above 1550°C and under stresses from 50 to 200 psi, are: (a) the activation energy for creep is about 5 ev, (b) the creep rate increases linearly with the applied stress, and (c) an anomalous creep phenomenon, dependent upon the strain and temperature, and possibly associated with "polygonization" and "recrystallization" of the material during creep, is present. Creep behavior of polycrystalline BeO may be interpreted in terms of the Nabarro-Herring concept of vacancy diffusion. The dislocation-climb concept, by Mott and Weertman, may apply at stresses sufficiently high to cause yielding. (auth)

10571
HIGH TEMPERATURE MECHANICAL PROPERTIES OF CERAMIC MATERIALS. I. MAGNESIUM DITITANATE. E. A. Bush and F. A. Hummel (Pennsylvania State Univ., University Park). J. Am. Ceram. Soc. 41, 189-95(1958) June.

The thermal expansion, modulus of rupture, and modulus of elasticity of sintered magnesium dititanate were measured as functions of temperature and thermal

history. The values increased with increasing temperature up to 1000°C., and hysteresis effects were found during cooling. Delayed strain effects were observed. These phenomena were attributed to the occurrence and recombination of internal fractures that result from stresses arising from the high anisotropy of thermal expansion of magnesium dititanate. (auth)

10572

ETCHING OF REFRACTORIES AND CERMETS BY ION BOMBARDMENT. T. K. Bierlein, H. W. Newkirk, Jr., and B. Mastel (General Electric Co., Richland, Wash.). J. Am. Ceram. Soc. 41, 196-200(1958) June.

Uranium oxide, aluminum oxide, and porcelain, as well as aluminum-aluminum oxide, a nickel-titanium carbide base cermet, and a cobalt silicide-titanium carbide, titanium diboride cermet, have been satisfactorily etched by ion bombardment for subsequent optical and electron microscope study. The method used is similar in almost all respects to the ion etching of metallic specimens. Representative optical and electron micrographs illustrate the applicability of the method for developing the microstructure of refractories and cermets. (auth)

10573

EXAMINATION OF THE SURFACE AND DOMAIN STRUCTURE IN CERAMIC BARIUM TITANATE. Victor J. Tennery and Franklin R. Anderson (U. S. Army Signal Engineering Labs., Fort Monmouth, N. J.). J. Appl. Phys. 29, 755-8(1958) May.

Polished and etched, as well as free surfaces, of barium titanate were studied by the direct carbon replica technique. Domain configurations of both the 90° and 180° type were made visible at a higher magnification than has been possible by optical methods. The behavior of 90° domains at a grain boundary was studied and photographed. Hexagonal and square growth patterns of the free surface were observed and photographed. (auth)

10574

AN X-RAY STUDY OF THE EFFECT OF MECHANICAL STRESS ON THE STRUCTURE OF POLYCRYSTALLINE BARIUM TITANATE. I. G. Ismailzade (Petroleum Inst., Academy of Sciences, Azerbaydzhan SSSR). Soviet Phys. (Doklady) 2, 350-3(1957) July-Aug.

The effect of mechanical pressures of 700 and 1000 kg/cm^2 on the structure of polycrystalline barium titanate was investigated by x-ray methods. The conditions of the experiments are described. It was found that under pressure the diffraction maxima in the reflections from the (200) and (301) planes are shifted toward larger angles, while the (002), (103), and (224) maxima are shifted toward smaller angles. With greater pressure the absolute values of the shifts are increased. An analysis of these data showed that under these pressures at room temperature the volume of a unit cell of polycrystalline barium titanate is practically unchanged, but the tetragonality c/a of the lattice increases. (J.S.R.)

10575

COLORATION OF $BaTiO_3$ SINGLE CRYSTALS. M. S. Kosman and E. V. Bursian (A. M. Herzen Leningrad State Padagogical Inst.). Soviet Phys. (Doklady) 2, 354-6(1957) July-Aug.

The coloration of $BaTiO_3$ crystals, grown by the method of Matthias, was investigated. The absorption spectrum of single crystals which became brown during growth is given. The crystals were then heated in hydrogen or in the reducing portion of an alcohol lamp flame, and it became almost transparent with a light yellow tint. After heating in air or oxygen the crystals again acquire a reddish-brown coloring. The absorption spectrum of these colorations is given. Field coloration was also observed. If a bleached single crystal is subjected to a voltage of 500 v at 300°, a slow progress of heavy reddish-brown coloration possessing a very even front is seen. If the field is reversed, the brown coloring leaves. The brownish coloration is very dependent on temperature. (J.S.R.)

Corrosion

Refer also to abstract 10721.

10576 HW-43986

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CORROSION OF STAINLESS STEEL AND TITANIUM IN PUREX 2WW. M. C. Fraser. Mar. 24, 1958. 18p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40 (mf OTS).

Heat-transfer corrosion rate data are presented which compare the resistance of three types of stainless steel and one type of titanium to corrosion by boiling synthetic Purex 2WW. Specific corrosion parameters investigated were time and temperature. Laboratory and mock-up data had the same order of magnitude. Pilot plant data are presented which illustrate some aspects of the nature of corrosion on heat-transfer surfaces as affected by material composition and method of fabrication. Types 304-L, 347, and 312 stainless steel were tested in the annealed, sensitized, or as-welded condition, and type A-70 titanium was tested in the annealed condition. Their corrosion rates were linear with time after an induction period, and, with two exceptions, were linear with temperature. At one thousand hours of exposure and a metal temperature of 145°C, sensitized type 347 had a corrosion rate of about fifty-seven mils per year, sensitized 304-L—about thirty-nine mils per year, sensitized 312—about thirty-three mils per year, and annealed A-70 titanium—about three mils per year. (auth)

10577 HW-55722

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

STUDY OF KAPL-120 LOOP RELATIVE TO ASA AND ASME CODE REQUIREMENTS. Fred E. Dearing, Jr. and J. E. Hanson. Apr. 25, 1958. 35p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

The present status of the Loop may be summarized: The system pressure is limited to 2370 psig by the 3-in. piping, so the relief valves should be reset from 2475 to 2370 psig. Welding done before standards were established was radiographed and repaired where necessary. It is stated that the Loop is within the intent of the ASA and ASME codes with the above exceptions. (T.R.H.)

10578 KAPL-M-GEG-11

Knolls Atomic Power Lab., Schenectady, N. Y.

RESULTS OF STRESS CORROSION TESTS OF TYPE 347 STAINLESS STEEL IN 500°F pH 10-11 LITHIUM HYDROXIDE. G. E. Galonian. May 2, 1958. 29p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The results of stress-corrosion tests of T-347 stainless steel in 500°F pH 10-11 lithium hydroxide are described. Stressed-bolt specimens heated to 626, 665, and 694°F to produce boiling were exposed for four weeks to determine the extent of corrosion to be expected. Also, tests were made to evaluate corrosion under conditions of leakage to the atmosphere. In the

boiling tests, corrosion scales thicker than expected were found, and metal penetration of about 0.001 in. occurred in some areas of the threads on the bolt specimens. No stress-corrosion cracking was found by microscopic or metallographic examination. No deposits of lithium hydroxide were found. Deposits of calcium carbonate were present. Tests to evaluate leakage to the atmosphere were made with a type 347 stainless steel bar stressed in a Schroeder embrittlement detector. A mixture of calcium carbonate with some lithium compounds was found on the test surface after four weeks. No severe corrosion attack was observed. (auth)

10579 MND-E-1322

Martin Co., Baltimore.

AUTOCLAVE TESTING OF TYPE 304 STAINLESS STEEL. Task 1, Phase 2. L. E. Phillips. May 1958. 63p. Contract DA-44-009-ENG-3043.

AISI Type 304 stainless steel U-bend test specimens were subjected to corrosive water in rocker autoclaves. One sample was suspended in the vapor phase and the other sample in the water phase of each autoclave. Water chemistry was statistically varied. Consistent test results were attained by careful control of the autoclave atmosphere. It was determined that oxygen and chlorides in the water were the only variables which contributed to the cracking of test specimens. The chloride level for cracking is dependent on test time, while the oxygen level appears to be independent of test time. Results indicate that a high oxygen level will not allow cracking at lower chloride levels, and conversely. This is in contradiction to some of the literature. The oxygen level necessary to induce cracking was found to be approximately four per cent. Test results also indicate that oxide film formation on stainless steel may be sufficient to induce stress corrosion cracking in the presence of chlorides, even if the environmental oxygen concentration is low. The most significant result of this work was the surprisingly high concentration of oxygen which was necessary to induce cracking. This suggests the possibility that untreated water can be used safely if adequate deaeration of the boiler is provided. Carbon steel samples were subjected to severe environmental conditions without cracking. General corrosion resistance was poor. Recommendations were made on the test environment of the miniature heat exchangers which are to be tested as a follow-up to the autoclave program. (auth)

10580 NP-6729

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

CORROSION OF TITANIUM AND TITANIUM-BASE ALLOYS IN LIQUID AND GASEOUS FLUORINE. G. L. Ericson, W. K. Boyd, and P. D. Miller. Apr. 30, 1958. 8p.

Unalloyed titanium and four titanium-base alloys were subjected to a simple preliminary corrosion evaluation in liquid and gaseous fluorine at temperatures between −320 and +220°F. All materials exhibit promising corrosion resistance under the test conditions. More elaborate experiments would be desirable to fully establish the utility of titanium in fluorine service. (auth)

10581 ORNL-2152

Oak Ridge National Lab., Tenn.

HRP RADIATION CORROSION STUDIES: IN-PILE LOOP L-4-11. J. R. McWherter and J. E. Baker. June 27, 1958. 50p. Contract W-7405-eng-26. $1.50 (OTS).

The sixth in-pile loop experiment, L-4-11, was completed. The loop operated in-pile for a total of 1109 hr, during which time the LITR energy output was 2175 Mwhr. The main-stream operating temperature was 250°C. During this run the loop was drained and then recharged with fresh solution. Based on oxygen data, the corrosion rate for the first 110 hr of operation was 5.0 mpy; for the next 232 hr the rate was 1.7 mpy. For the first 120 hr of operation with the second fuel solution the corrosion rate was 7.2 mpy, and for the remainder of the run the rate was 1.9 mpy. The nickel data gave parallel results. Corrosion specimens of a large variety of zirconium alloys, titanium alloys, and stainless steels, as well as specimens of synthetic sapphire, sintered alumina, platinum, and Incoloy, were included in the experiment. Corrosion rates of most of the zirconium alloys, titanium alloys, and stainless steels were generally consistent with rates observed in the previous in-pile loops. The zirconium alloys Zr-3 (3% Ag), Zr-3 (0.52% Sn, 5.71% Ti, 40 ppm N_2), Zr-3 (0.52% Sn, 0.28% Fe, 5.66% Ti, 60 ppm N_2), Zr-3 (1.4% Fe), and Zr-4 (0.7% Fe, 2.8% Cr) corroded at rates about two to three times those observed for Zircaloy-2 at the same power density. The zirconium alloy containing 3.84% Al and 2.5% Mn corroded at rates about 10 to 20 times those for Zircaloy-2. The zirconium alloy containing 2% niobium corroded at the same rate as Zircaloy-2 in the core but at a much higher rate, 17 mpy, in the in-line position. However, a zirconium alloy containing 15% niobium corroded at less than one-third the Zircaloy-2 corrosion rates in the core and exhibited rates similar to Zircaloy-2 in the in-line position. Corrosion rates for Incoloy were found to be about the same as those for stainless steel exposed to similar conditions. All sintered aluminum oxide specimens in the main stream disintegrated; however, the aluminum oxide bearings in the low temperature region of the pump showed no measurable wear. Synthetic sapphire became cloudy and corroded at a rate of 12 mpy. Platinum was slightly affected in the core. (auth)

10582 WADC-TR-57-302

Bell Aircraft Corp., Buffalo.

INVESTIGATION OF CORROSION INHIBITORS FOR FUMING NITRIC ACID. [Period covered] November 21, 1955 to June 7, 1957. William H. Bergdorf and Edward J. Kinsey, Jr. Sept. 12, 1957. 156p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: CORROSION AND CORROSION PREVENTION. Contract AF33(616)-3056. (AD-151116).

Development of a corrosion inhibitor for fuming nitric acid that has corrosion-inhibiting and scale and sludge-formation properties superior to those of hydrofluoric acid was investigated. Ammonium hexafluorophosphate in amount equivalent to 0.30% by weight hydrofluoric acid was found to provide better inhibition to the corrosion of 61S-T6 aluminum alloy and 17-7PH and AISI Type 304L stainless steels than 0.70% by weight hydrofluoric acid under the test conditions. Optimum inhibitor concentrations for Types I and III specification acids and inhibitor depletion rates for eight inhibitors including hydrofluoric acid were determined. Effects of inhibitor up to five times optimum inhibitor concentration of each of the several inhibitors were measured in terms of slush or freezing point of inhibited acid media which had been subjected to wide variation in temperature and short time storage conditions. Measurements of the mechanical properties of welded specimens of the aluminum and stainless steel alloys that had been immersed in the liquid and vapor phases of eight inhibited acid systems for thirty days at 120°F showed that no significant change in properties

was effected by these exposure conditions. Film-formation studies were conducted on aluminum and stainless steel specimens that had been exposed to the liquid and vapor phases of the several inhibited systems and subsequently rinsed in water and methylene chloride. Both rinses removed the inhibited acids from the specimens, but methylene chloride failed to remove corrosion products. Hydrofluoric acid, phosphoric acid plus hydrofluoric acid, and ammonium hexafluorophosphate at optimum concentrations dissolved in specification Types I and III acid media were tested in vessels fabricated from the aluminum and stainless steel alloys for a period of 60 days at 70, 120, and 160°F. Ammonium hexafluorophosphate produced the greatest pressures during the test period. This inhibitor, however, suffered the smallest loss in concentration and in general provided the best inhibition. (auth)

10583 WAPD-CDA(I)-86

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]

CHEMISTRY OF THE NINTH PWR FUEL MATERIAL TEST X-1 LOOP NRX REACTOR. Interim Report II. R. Ehrenreich. [1957]. 42p. $7.80(ph OTS); $3.30 (mf OTS).

The results of observations of loop water and loop piping during a 117-day reactor run are tabulated. Data are given on: behavior of defected and non-defected Zircaloy-2 clad UO_2 PWR fuel specimens; specific activities and distributions of radionuclides in primary water; conductivity, gas analyses, O_2 concentration, and pH of the water during the run. (See also WAPD-CDA(I)-3.) (T.R.H.)

10584 WAPD-PWR-PMM-1240

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

OUTLINE OF PWR ALTERNATE CONTROL MATERIAL INFORMATION OBTAINED AT BETTIS. Aug. 15, 1957. 38p. $6.30(ph OTS); $3.00(mf OTS).

The tensile properties of solid metal and powder metal Ag-15 In-5 Cd alloys are summarized. Corrosion data for Ag-base alloys are tabulated for the following water conditions: 550°F hydrogenated, high pH(LiOH), 550°F high pH(LiOH) alternating hydrogenated and oxygenated, 650°F ammoniated, 650°F hydrogenated high pH(LiOH) and 650°F hydrogenated high pH(NH_4OH). The density vs. compacting pressure curve for Ag-15 In-5 Cd powder metal product and microstructure of Ag-15 In-5 Cd sintered and extruded powder metal compact are shown. Corrosion curves of Ag-base alloys (mg/cm^2 vs. time) in 500, 550, 600, 650°F static water and 600°F dynamic water are given. (M.H.R.)

10585 WAPD-T-416

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

CORROSION BEHAVIOR OF URANIUM–ZIRCONIUM ALLOYS IN HIGH TEMPERATURE WATER AND STEAM. S. Kass and K. M. Goldman. Apr. 1958. 26p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

For presentation at 1958 Nuclear Congress, March 17-21, 1958, Chicago, Illinois.

The corrosion behavior of uranium–zirconium alloys containing 50 wt. % U has been determined in high temperature water at 600 and 680°F and in steam at 750°F. Data for other compositions in the range of 10 to 60 wt. % uranium are also presented to indicate the general effect of uranium content on corrosion behavior of uranium–zirconium alloys. It was found that, in general, the 50 wt. % U–50 wt. % Zr alloys are essentially unaffected by heat treatment. They exhibit a linear rate of corrosion at 680°F. These rates increase with increasing temperature according to the Arrhenius relationship. Corrosion life as a function of uranium content and temperature is presented and a mechanism of corrosion is suggested. The increase in total hydrogen content of the 50 wt. % U–50 wt. % Zr alloys resulting from corrosion at 680°F in water is presented. From a comparison of oxidation data obtained in water with those obtained in dry oxygen at similar temperatures, it is concluded that hydrogen is probably not involved in the mechanism of corrosion of these materials because of the good agreement between the two kinds of data. This idea is further substantiated by data from another laboratory which indicates that the hydride formed in the 50 wt. % U–50 wt. % Zr alloy is similar to $ZrH_{(1.2\ to\ 1.4)}$ rather than to uranium hydride. (auth)

10586

EFFECT OF α-ACTIVITY ON THE CORROSION RATES OF PLATINUM AND ZIRCONIUM IN HYDROBROMIC ACID. D. M. Ziv and I. A. Efros. Atomnaya Energiya 4, 293-4(1958) Mar. (In Russian)

The corrosion rates of 99.9% pure platinum and zirconium foils in hydrobromic acid in the presence of Po^{210} with an α emissivity of 0.3 to 1 mc were determined. At room temperature the presence of α activity did not affect the corrosion rate of platinum foil; at 80°C a slight increase in corrosion rate was observed. The completely submerged specimens corroded faster than the partially submerged ones. The presence of Po in quantities of 0.25 to 0.3 mc increased the corrosion rate of zirconium ~100 times. (R.V.J.)

10587

CORROSION RESISTANCE OF FIVE STAINLESS ALLOYS IN NITRIC ACID CONTAINING CHLORIDE. I. I. Tingley (Dept. of Mines and Technical Surveys, Ottawa, Can.). Corrosion 14, 273t-4t(1958) June.

A number of stainless steels and the new alloy Ni-O-nel were tested in solutions 8N in nitric acid and 0.2N in chloride. Stainless steels Types 304L, 316, 309S Nb, and 329 were all resistant to the liquid and hot vapor, but only Type 329 showed good resistance to the condensing vapors from these solutions. The resistance of this steel was about 1000 times as great as that of Types 304L, 316, and 309S Nb. (auth)

10588

INHIBITION OF CORROSION OF STEEL BY TETRAMETHYLAMMONIUM BROMIDE. Rudolph Macy and B. L. Harris (Army Chemical Center, Md.); W. C. Bull (Spencer Chemical Co., Pittsburg, Kansas); and J. W. Eastes (Scott Paper Co., Chester, Penna.). Corrosion 14, 280t-2t(1958) June.

A review is made of work leading to the discovery that tetramethylammonium bromide (TMB) is an excellent inhibitor of corrosion of steel by bis (2-chloroethyl) sulfide (H). The nature of the corrosion problem involved is considered for both Levinstein H and distilled H. The search for a stabilizer for Levinstein H is described. Data are reported with no stabilizer, 1 percent hexamine stabilizer and 1 percent TMB stabilizer to show the rate of decomposition of Levinstein H in a 75 mm shell, rate of pressure developed in a 75-mm shell filled with Levinstein H, and rate of pressure development in 75-mm shell filled with distilled H. The rate of loss of liquid filling at 150 F with distilled H filled to 10 percent void in 75-mm shell is reported for no stabilizer, 1 percent hexamine and 0.5 percent TMB. (auth)

10589

INHIBITION OF TITANIUM IN FUMING NITRIC ACID. J. B. Rittenhouse (California Inst. of Tech., Pasadena)

and C. A. Papp (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Corrosion 14, 283t-4t(1958) June.

Storage tests were conducted to determine the effectiveness of oxygen in inhibiting the corrosion reaction of titanium in fuming nitric acid (FNA). In these tests, which were of 28 days duration at a temperature of 30 C, the samples investigated were ½-inch squares (0.020 inch thick) of commercially pure titanium (75A) and a binary 8%-manganese alloy (C110M). The specimens were stored in Teflon-lined aluminum pressure vessels at 50% ullage. The pressure vessels were of the following types: vented to the atmosphere, sealed with air in the vapor space, sealed with oxygen atmosphere in the vapor space, and equipped for a 1-ml/minute oxygen flow through the vapor space. Results of the investigation indicated no inhibition of titanium corrosion by oxygen, but confirmed the inhibiting effect of a water content of 1 to 2% by weight in the FNA. (auth)

10590

LABORATORY STUDIES RELATING MINERAL QUALITY OF WATER TO CORROSION OF STEEL AND CAST IRON. T. E. Larson and R. V. Skold (Illinois State Water Survey, Urbana). Corrosion 14, 285t-8t (1958) June.

The influence of combinations of various normal mineral components in domestic waters on the rate of corrosion of cast iron and steel and on the development of tuberculation is reported. Tests were conducted with air saturated waters at room temperature with velocities of 0.1–1.0 fps and with pH controlled by carbon dioxide. The ions considered are chloride, sulfate, bicarbonate and calcium at pH 6.8–8.3. (auth)

10591

PORCELAIN ENAMEL. CORROSION PROTECTION FOR CHEMICAL PROCESS EQUIPMENT. Ind. Eng. Chem. 50, No. 6, 75A-6A(1958) June.

A discussion is presented of the uses of porcelain enamel in corrosion protection for chemical process equipment, including physical properties of the enamels, heat transfer efficiency, ease of cleaning enameled surfaces, and cost comparisons. (J.R.D.)

10592

QUANTITATIVE HIGH-TEMPERATURE OXIDATION OF PORCELAIN ENAMELED IRON. H. G. Lefort and A. L. Friedberg (Univ. of Illinois, Urbana). J. Am. Ceram. Soc. 41, 216-26(1958) June.

Continuous gain-in-weight method was used for quantitative measurement of the oxidation taking place at elevated temperatures for long periods of time on enameled iron and stainless steel. Studies included the effect of various thicknesses of nickel plate on iron, the effect of nickel plating on enameled and unenameled specimens, the effect of sand blasting or mechanical abrading and chemical cleaning before enameling, and the effect of temperature on the rate of oxidation. (auth)

10593

CORROSION SCREENING OF COMPONENT MATERIALS FOR NaK HEAT EXCHANGE SYSTEMS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 24, Session 23. Samuel J. Basham, John H. Stang, and Eugene M. Simons (Battelle Memorial Inst., Columbus, Ohio). New York, American Institute of Chemical Engineers, 1958. 26p.

Sixty-one materials which might be useful for special components, such as valve-seat inserts, valve plugs, shaft-seal facings, and bearings, in high-temperature NaK flow systems were screened in tilting-furnace corrosion experiments. These include high-temperature alloys, pure metals, cermets, and ceramics. The standard test consisted of confining a specimen to the hot end of a sealed Inconel X capsule partially filled with NaK and exposing the capsule for 110 hr (5000 cycles) in a tilting furnace. The hot end of the capsule was controlled at 1600 F, while the cold end was 1200 F. Post-test corrosion evaluations were based on metallographic examinations of the specimen weight-change measurements, capsule-wall examinations, and specimen surface-roughness changes. The materials were divided into three classes according to corrosion resistance: Class I (most promising)—attacked to a depth of 1 mil or less; Class II (marginal)—attacked to a depth of 1 to 4 mils; Class III (unsuitable)—attacked to a depth greater than 4 mils. (auth)

10594

INSTRUMENTATION EXPERIENCE WITH 2000 P.S.I. 600°F SLURRY TEST LOOPS FOR PAR HOMOGENEOUS REACTOR PROJECT. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 5, Session 17. E. A. Goldsmith and W. W. Wentzel (Westinghouse Electric Corp. and Pennsylvania Power & Light Co., Pittsburgh). New York, American Institute of Chemical Engineers, 1958. 15p.

The successful application of standard instrumentation to test loops circulating aqueous slurries of mixed thorium and uranium oxides at 1800 psi and 580°F, during 15,000 hours of operation and under conditions simulating those planned for the primary system of a large reactor plant, further defines problems associated with the measurements of pressure, temperature, flow, and level within a relatively unexplored field of instrumentation experience. Several special instruments, installed for evaluation as components of a final plant, are also discussed. The over-all experience gained should prove of value to those contemplating nuclear reactors to use similar aqueous suspensions as fuel. (auth)

Geology and Mineralogy

10595 TEI-700

Geological Survey.

GEOLOGIC INVESTIGATIONS OF RADIOACTIVE DEPOSITS. Semiannual Progress Report [for] June 1, to November 30, 1957. Dec. 1957. 288p. $4.00(OTS).

Geologic mapping as part of the uranium investigations on the Colorado Plateau was started in southwestern Colorado early in 1947. Since that time the original program has been extended, and prior to this report period field work had been completed in the following project areas: Southwestern Colorado; Monument Valley, Arizona; Monument Valley, Utah; Carrizo Mountains, New Mexico; Capitol Reef, Utah; White Canyon, Utah; Clay Hills, Utah; Deer Flat, Utah; Bull Canyon, Colorado; Slick Rock, Colorado; Uravan, Colorado; Sage Plain, Colorado-Utah; La Sal Creek, Colorado-Utah; Elk Ridge, Utah; and East Vermillion Cliffs, Utah. During the report period field and/or office work continued in the following areas: Slick Rock, Colorado; Uravan, Colorado; Klondike Ridge, Colorado; Western San Juan Mountains, Colorado; Ute Mountains, Colorado; Lisbon Valley, Utah-Colorado; Moab-Inter-River, Utah; Orange Cliffs, Utah; Circle Cliffs, Utah; Abajo Mountains, Utah; Grants, New Mexico; and Laguna, New Mexico. During the report period papers were published on geologic

work previously completed on the Colorado Plateau. (auth)

10596

THE DETERMINATION OF THE ABSOLUTE AGE OF GEOLOGICAL FORMATIONS. B. V. Atomnaya Energiya 3, 265-6(1957)

The 6th congress of the Commission of the Geological-Geographical Department of the Academy of Science was held at Sverdlovsk from May 22 to May 27, 1957. The three principal methods of determining the age of uranium–thorium–lead, uranium–thorium–helium, and potassium–argon formations were successfully applied. In addition, the methods of determining the degree of enrichment of argon, potassium flame photometry, and the process of determining the smallest quantities of lead were considerably improved. The age of rock could be determined at 1900 million years for North Karelia and for some parts of the Ukraine at 1600 to 2000 million years. In the Caucasus 4 sections were investigated the age of which fluctuates between 15 and 400 million years. (TCO)

10597

OCCURRENCE OF URANIUM IN DIFFERENT ROCKS. V. I. Gerasimovskiy. Atomnaya Energiya 3, 525-9(1957).

A knowledge of the conditions of the formation of uranium deposits depends on a knowledge of the form of uranium in rocks. The latest researches indicate that many different uranium minerals are formed (oxides, hydroxides, sulfates, carbonates, silicates, phosphates, arsenates, vanadates, etc.). Because of isomorphous mixtures uranium enters the crystal lattice of non-uranium minerals. In scattered quantities uranium enters rocks in absorbed form (ion absorption) and dissolved in the rock water. After the formation of rock an exchange of the total content of uranium between these phases occurs. (J.S.R.)

10598

GEOTHERMAL METHOD WHEN PROSPECTING FOR URANIUM ORES. K. M. Atomnaya Energiya 3, 563-4 (1957).

Because of radioactive decay in uranium ores heat is released which accumulates in the surrounding rock. The geothermal method in the search for uranium is based on this fact. This method is used especially in the Colorado region. The area to be searched is overlaid with a network of drill holes of 1.5 to 3.0 m depth, in which the temperature measuring is carried out. If anomalies occur here, the drill holes are deepened (down to 18 m) and the temperature measurings repeated. From the measurements isotherms are drawn which permit a demarcation of the area containing uranium. The geothermal method is a good supplement to the radiometric search but no replacement for it. (TCO)

10599

NEW INDUSTRY SAMPLES OF URANIUM CONTAINING ROCKS. K. M. Atomnaya Energiya 3, 564-5(1957).

In 1957 data on the discovery of asphalt sandstone uranium ores in the Ambrosia Lake area of New Mexico were published. The area has a length of 15 km and a width of 1.5 km. The ore veins have an average width of 3.3 km. The average U_3O_8 content is 0.30%, and the total occurrence is estimated to be 140,000 tons of U_3O_8. More than 50,000 drill holes are being drilled a month. A plant for production of uranium concentrates was built and can process 3,300 tons of ore a day. The plant is 40 km north of a water reservoir. Two more plants with a combined daily output of 2,250 tons are planned. (J.S.R.)

10600

URANIUM IN CARBONACEOUS ROCKS IN THE TOWNSEND AND HELENA VALLEYS MONTANA. George E. Becraft. U. S. Geol. Survey Bull. 1046-G. 1958. 19p. and 1 illus.

Uranium-bearing carbonaceous shale and lignite beds are exposed in four areas in the Townsend and Helena Valleys in western Montana. The greatest number of exposures is in an area of several square miles northeast of Winston in the Townsend Valley. The uranium-bearing beds are in the lower part of a Tertiary unit that consists largely of thin-bedded white to buff pure and impure tuffs, locally altered to bentonite. The uranium occurrences, none of which appear to be commercial, have three characteristics in common: (1) They are in and adjacent to carbonaceous shale or lignite interbedded with light-gray or white fine-grained tuffs and lapilli tuffs; (2) the stratigraphic section in the vicinity of the deposits includes bentonite and partly bentonized tuff; and (3) the distribution of the uranium in the favorable beds is erratic. The uranium was probably leached from the tuffs and lapilli tuffs by meteoric water during bentonization and was concentrated in the carbonaceous shale and lignite. Similar Tertiary rocks are present in many of the major valleys in western Montana and probably warrant prospecting for uranium. Areas containing white fine-grained tuff or lapilli tuff, bentonite, and coal or carbonaceous shale would be particularly favorable for prospecting. (auth)

Metals and Metallurgy

Refer also to abstracts 10462 and 11148.

10601 AECU-3692

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE SYSTEM ZIRCONIUM–IRON–TIN. Status Report No. 4 [for] July 1, 1957–March 31, 1958. Lee E. Tanner. Apr. 24, 1958. 16p. Project No. B 068. Contract AT(11-1)-315. $3.30(ph OTS); $2.40(mf OTS).

A study of the solubility limits of iron and tin in alpha zirconium at temperatures below 500°C is in progress. Dilute alloys were prepared by arc-melting using the highest purity materials. Heat treatment of the alloys involves homogenization at 800°C followed by severe cold work prior to extended anneals at temperatures between 200 and 500°C in 50-degree intervals. Metallographic examination of annealed and quenched structures is the primary mode of investigation. Some magnetic susceptibility studies were also made. (auth)

10602 AECU-3693

Westinghouse Electric Corp. Research Lab., East Pittsburgh, Penna.

EVALUATION OF MECHANICAL AND PHYSICAL PROPERTIES OF ANNEALED HAFNIUM. Research Report 100FF1005-R1. E. T. Wessel. Mar. 20, 1956. 46p. $7.80(ph OTS); $3.00(mf OTS).

A critical need exists for larger and more readily available supplies of hafnium. Considerable quantities of grade no. 2 hafnium crystal bar material have been accumulated and are available. However, it has been the general feeling that grade no. 2 material was inferior to grade no. 1 and was unacceptable for the applications in question. Therefore a program was initiated to explore the possibility of being able to use grade no. 2 crystal bar either alone or blended with various amounts of grade no. 1 material. The purpose of this phase of the investigation was to establish base-line

data regarding the mechanical and physical properties of annealed hafnium and to compare the properties obtained for heats prepared using various blends and grades of raw materials and different melting practices. (auth)

10603 AECU-3695
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
MATERIALS MANUAL. May 1957. 116p. (M-6232). $19.80(ph OTS); $6.30(mf OTS).

Issued in loose-leaf form to facilitate periodic revisions.

The considerations to be made in choosing an alloy for use under certain conditions are discussed. The properties of carbon steel, Mn–Mo steel, stainless steels, Stellites, Haynes-25, Inconel X, Monel, Zircaloy-2, and Zircaloy-3 are given, and purchase specifications stated. (T.R.H.)

10604 BMI-1264
Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF THE LIQUIDUS IN ALUMINUM–URANIUM ALLOYS. Victor W. Storhok, Arthur A. Bauer, and Ronald F. Dickerson. May 1, 1958. 13p. Contract W-7405-eng-92. $3.30(ph OTS); $2.40(mf OTS).

Liquidus temperatures in the aluminum–uranium system have been redetermined for alloys containing 13 to 50 wt. % uranium. Thermal analysis, electrical-resistance measurements, and metallography were employed in the investigation. The binary aluminum–uranium alloys studied and, their corresponding liquidus temperatures are as follows: 17 wt. % uranium, 755°C; 17.5 wt. % uranium, 780°C; 24.5 wt. % uranium, 954°C; 30.9 wt. % uranium, 1068°C; 41.6 wt. % uranium, 1190°C; 51.2 wt. % uranium, 1265°C. Eutectic and peritectic temperatures were determined to be at 640 and 732°C, respectively. Binary alloys containing ternary additions of up to 1 wt. % silicon and up to 0.5 wt. % magnesium were studied also. Neither silicon nor magnesium were found to have any effect on the liquidus temperatures. However, silicon lowered the peritectic temperature from 732 to 700°C and among alloys containing less than 30 wt. % uranium had a refining effect on eutectic UAl_4 particles. The only effect that could be attributed to the magnesium additions was a tendency toward coarsening the UAl_4 particles in alloys containing less than 30 wt. % uranium. (auth)

10605 BR-763
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
NOTE ON THE ANNEALING OF COLD ROLLED ALUMINIUM AT 85°C. B. W. Mott and J. R. Murray. Mar. 8, 1949. Decl. Apr. 18, 1958. 7p.

No appreciable drop in hardness occurs in cold worked Al from 99.3 to 99.8% purity after annealing for periods up to six months at 85°. (J.E.D.)

10606 CF-58-6-9
Oak Ridge National Lab., Tenn.
JOINING OF BERYLLIUM–A SURVEY OF THE UNCLASSIFIED LITERATURE. N. A. Brown. June 2, 1958. 9p. [Contract W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The unclassified literature on the joining of beryllium was surveyed and is summarized. The fields covered are fusion welding, self-welding (diffusion- or pressure-welding), and brazing. The most successful attempts in each field are outlined and other work is referenced. (auth)

10607 IGRL-T/C-82
THE DIFFUSION OF CARBON IN ALLOY STEELS. W. Seith and F. Bartschat. Translated by J. Standring from Z. Metallk. 34, 125-30(1942). 11p.

Diffusion of carbon from an unalloyed into an alloy steel and trend of concentration as a function of diffusion path are studied. The phase diagram of ternary systems and the Nernst distribution law are considered. (auth)

10608 KAPL-1774
Knolls Atomic Power Lab., Schenectady, N. Y.
DEVELOPMENT OF A NEW PROCESS FOR CUTTING STAINLESS STEEL. R. A. Gahr. Apr. 22, 1957. Changed from OFFICIAL USE ONLY June 4, 1958. 27p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The primary objective of this program was threefold: first, to develop a new procedure to cut certain thicknesses of stainless steel with exceptional speed and edge characteristics by use of the new Linde heliarc cutting torch; second, to provide a portable remotely controlled automatic jig to carry the torch or other light tools around fixed or open-end pipe; and third, to construct a main control panel to enable the operator to use the same torch and equipment both manually and automatically. (auth)

10609 KAPL-M-FWW-3(Rev. 1)
Knolls Atomic Power Lab., Schenectady, N. Y.
CREEP STUDIES OF ASTM A-302 GRADE B FIRE BOX STEEL AT 600, 700, 800°F. F. W. Wiesinger. May 19, 1958. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Creep tests were conducted on ASTM Type A-302 Grade B Fire Box steel at 800, 700, and 600°F. Included in the compilation of the data are standard elongation–time curves and creep rates as a basis for engineering analysis and evaluation. Data obtained at 600°F were questionable because of the low temperature involved. (auth)

10610 KAPL-M-KM-1
Knolls Atomic Power Lab., Schenectady, N. Y.
A NEW TECHNIQUE FOR POLISHING AND ETCHING ZIRCALOY II AND U–Zr ALLOYS. K. Minassian. Apr. 3, 1958. 6p. Contract W-31-109-eng-52. $1.80 (ph OTS); $1.80(mf OTS).

An investigation was made of polishing and etching Zircaloy II and U–Zr alloys by automatic sanding and an etch-polish to obtain a highly polished surface. A micro-finish has to be obtained in order to use the etchant developed (30cc HNO_3, 3ccHF, 30cc Lactic acid). Clearer structural definition of U–Zr alloy results from the use of this etchant. Etch pits which are commonly observed in Zircaloy II and U–Zr alloys are also considerably reduced. (auth)

10611 KAPL-M-RLM-15
Knolls Atomic Power Lab., Schenectady, N. Y.
THERMAL EXPANSION OF ZIRCALOY-2 BETWEEN ROOM TEMPERATURE AND 1000°C. R. L. Mehan and G. L. Cutler. May 16, 1958. 22p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Thermal expansivities for 25% cold-rolled and annealed Zircaloy-2 were determined in the three principle directions of rolling. It was found that the thermal expansion between 30°C (86°F) and 600°C (1112°F) could be expressed by the equation: $L_T = L_O [0.99983 + 5.628 \times 10^{-6} T + 1.581 \times 10^{-9} T^2]$. The start of a transformation on heating, assumed to be the $\alpha \rightarrow \beta$ reaction, was found to be 827 ± 7°C (1521 ± 12°F) and was completed at 985 ± 5°C (1805 ± 9°F). No anisotropic effect on the coefficients of expansion was found. This is perhaps due to departure from the recrystallization tex-

tures established for heavily cold-reduced zirconium, although experimental error may have masked small differences. (auth)

10612 NLCO-727
National Lead Co. of Ohio, Cincinnati.
THORIUM—A LITERATURE SEARCH. Earl W. Mautz. Mar. 18, 1958. 19p. Contract AT(30-1)-1156. $0.75 (OTS).

A literature search on "Thorium" from Chemical Abstracts, Volume 1, (1907) through Volume 27 (1933) is presented, exclusive of references to medical, radiochemical, mineralogical, analytical and spectrochemical headings. (auth)

10613 NMI-1204
Nuclear Metals, Inc., Cambridge, Mass.
TEXTURES IN EXTRUDED URANIUM. R. B. Russell. May 27, 1958. 26p. Contract AT(30-1)-1565. $4.80 (ph OTS); $2.70 (mf OTS).

The preferred orientation or texture of alpha-extruded, cold-swaged, recrystallized, and beta-quenched uranium has been determined. An attempt is made to predict the mean thermal expansion coefficients from the texture and principal crystallographic thermal expansion coefficients. (auth)

10614 NP-6712
California. Univ., Berkeley. Inst. of Engineering Research.
A STUDY OF THEORIES OF FRACTURE UNDER COMBINED STRESSES. Final Report. I. Cornet and R. C. Grassi. Feb. 1958. Includes Appendix: PHYSICAL SIGNIFICANCE OF INVARIANTS OF STRESS USED IN THE THEORY OF PLASTICITY. V. V. Novozhilov. Translated by B. Bresler from Priklad. Mat. i Mekhan. 16, 617-19(1952). 45p. OOR Project No. TB2-001 (1182). Contract DA-04-200-ORD-171, T. O. 10.

An investigation of the failure, under stresses, of brittle materials such as cast iron is reported. Data are presented for cast nodular iron and high silicon cast iron, along with a review of other investigations. Various failure theories are discussed and conclusions of the cause, from an engineering view point, the phenomenological viewpoint, and from the standpoint of fundamentals are drawn. (J.R.D.)

10615 NP-6733
California. Univ., Berkeley. Minerals Research Lab.
ANALYSIS FOR DIFFUSION DURING PLASTIC DEFORMATION. Technical Report No. 1. J. Simmons and John E. Dorn. Jan. 24, 1958. 21p. Contract AF49 (638)-58.

The general equation for self-diffusion in deforming media is presented. Methods of analyses for determining the self-diffusivity as a function of time for prescribed strain histories are given for specinl cases of linear diffusion. No unrealistic assumptions relative to the constancy of the diffusivity with time are made. (auth)

10616 NP-6759
United Kingdom Atomic Energy Authority. Industrial Group. Culcheth Labs., Culcheth, Lancs, England.
BRITTLENESS IN METALS. PREPRINTS OF PAPERS FOR A CONFERENCE TO BE HELD AT CULCHETH LABORATORIES ON 1st NOVEMBER 1957. Oct. 1957. 64p.

Papers are presented on: theory of brittle fracture in steel and its application to radiation embrittlement; the transition temperature in notched specimens; mechanical properties of neutron-irradiated steels; effects of radiation on steels; radiation testing of steels; possible effects of radiation on H_2 embrittlement of steels; a survey of H_2 embrittlement of steels; ductile-brittle transition in non-ferrous b.c.c. metals; cleavage fracture in hexagonal metals; and the ductility problem of reactor Be. (T.R.H.)

10617 NP-6770
Syracuse Univ., N. Y. Research Inst.
HIGH TEMPERATURE MATERIALS, THEIR STRENGTH POTENTIALS AND LIMITATIONS. Proceedings of the Fourth Sagamore Ordnance Materials Research Conference Conducted at Sagamore Conference Center, Racquette Lake, New York. August 21, 22, and 23, 1957. 358p. Contract DA-30-115-ORD-854. (MET-497-582).

Thirteen papers are presented: Theory of High-Temperature Deformation of Metals; Theory of High-Temperature Strength of Alloys; A Survey of Recent Results on Experimental Determinations of Activation Energies for Creep; The Stability of Microstructures and Related Physical Properties at High Temperatures; The Relation of Microstructure and High-Temperature Strength; Tensile Properties of Some Structural Sheet Materials Under Rapid Heating Conditions; Mechanical Properties of Structural Materials Under Conditions of Rapid Heating and Rapid Loading; Thermal Fatigue of Ductile Materials; Plastic Strain Absorption as a Criterion for High-Temperature Design; Strain Cycling and Thermal Fatigue; Design Under Conditions of Relaxing Complex Stress Concentrations; A Survey of the Effects of Nonsteady Load and Temperature Conditions on the Creep of Metals; and Chemistry at High Temperatures and Pressures. Data tabulations are given on: creep activation energy of Al, Au, Cu, Fe, Ni, In, Cd, Pb, Zn, Mg, and Al—Mg; hardness of Cu vs. cold-work; hardness of carbon steel vs. temperature; strength of Al—Mg vs. strain rate; strength of steel vs. cold work and heat treatment; strength of Al—Cu—Mg vs. heat treatment; high-temperature properties of Co—Fe—Ni; tensile properties of steel, aluminum alloys and Inconel-X sheet under rapid heating conditions; and strain cycling and thermal stress fatigue of Inconel, stainless steel, various steels, Cr—Mo—Ni, Al, Cu, and Al—Mg. (T.R.H.)

10618 NRL-5133
Naval Research Lab., Washington, D. C.
THE EFFECT OF ATMOSPHERE ON CREEP-RUPTURE PROPERTIES OF A NICKEL—CHROMIUM—ALUMINUM ALLOY. P. Shahinian and M. R. Achter. Mar. 27, 1958. 16p.

The role of ductility in the effect of environment on creep and rupture properties was investigated employing a 76% nickel, 19% chromium, and 4% aluminum alloy. Creep-rupture tests were conducted primarily in air and in vacuum at 1300, 1500, and 1900°F. It was found that at low temperatures and high stresses, time-to-rupture was longer in vacuum that in air, but that at high temperatures and low stresses the reverse was true. Generally, conventional minimum creep rates were unaffected by environment. An unusual creep curve was obtained in air at the higher temperatures, apparently due to oxidation; these specimens showed markedly greater than expected rupture time and ductility. The influence of atmosphere was related to the mode of crack formation in this relatively brittle material and can be explained by previously advanced mechanisms. (auth)

10619 NRL-M-3434
Naval Research Lab., Washington, D. C.
DEVELOPMENT OF ALUMINUM ALLOYS FOR ELEVATED TEMPERATURES: AN INVESTIGATION OF

COMPLEX ALLOYS OF ALUMINUM WITH MISCHMETAL AND OTHER ELEMENTS. Blake M. Loring and James B. Russell. Mar. 22, 1949. 37p.

Report is made of study of strength at elevated temperatures of aluminum alloys containing mischmetal with additions of copper, nickel, silicon, manganese, magnesium, chromium, cobalt, tungsten, molybdenum, and zirconium. Tensile strength and elongation tests were made at room temperature and at 750°F; stress-rupture tests were made at 700°F. In addition, studies were made of the effects of varying normal components and of additional elements in commercial aluminum alloy compositions. (auth)

10620 NYO-8526

Penn-Texas Corp., New York and Stevens Inst. of Tech., Hoboken, N. J. Powder Metallurgy Lab.

COMPACTING AND SINTERING OF METAL POWDERS WITHOUT THE APPLICATION OF PRESSURE. Henry H. Hausner, Donald P. Ferriss, and Frank W. Heck. May 25, 1957. 20p. Contract AT(30-1)-1991. $3.30(ph OTS); $2.30(mf OTS).

The properties of a mass of loose powders are compared with those of powders compacted under pressure, and it has been shown that uncompacted powders have many properties which facilitate sintering. The rate of sintering, expressed in terms of densification, has been determined for uncompacted 316 stainless steel powders for the sintering temperature 1300°C. Various mixtures of fine and coarse powder particles were prepared in order to determine the mixtures which result in maximum apparent density (approximately 60% coarse–40% fine particles). It has been shown that maximum apparent density is not necessary, nor even desirable, to obtain maximum sintered density, which can be reached with mixtures of approximately 20% coarse–80% fine particles. The experimental work revealed that the sintered density is a function of the density of the powder mass before sintering plus another function–that of the total particle surface area. It has been shown further that, without any application of pressure to the powder, sintered densities as high as 7.0 g/cc, or 87.8% of the material's theoretical density, can be obtained at a relatively low sintering temperature. (auth)

10621 ORNL-2520

New England Materials Lab., Inc., Medford, Mass.

FINAL REPORT—DEVELOPMENT AND TESTING OF AIR-MELTED NICKEL–MOLYBDENUM ALLOYS WITH MINOR ALLOYING ADDITIONS. O. Preston, C. F. Floe, and N. J. Grant. June 16, 1958. 41p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 584. $1.25(OTS).

Stress-rupture, tensile, and embrittlement testing of six 4800-lb air-melted experimental heats of nickel–molybdenum alloys containing 13 to 20% Mo with additions of Mn, Fe, Si, Cr, Al, Ti, W, Cb, and C are covered. Results for commercial Hastelloy B are included for purposes of comparison. (auth)

10622 RDB(C)/TN-24

Gt. Brit. Culcheth Labs., Culcheth, Ches., England.

THERMAL CONDUCTIVITY OF METALS AND URANIUM COMPOUNDS. A REVIEW OF PROGRESS TO DECEMBER 19, 1952. I. P. Bell and J. J. McDonald. Feb. 27, 1953. Decl. Apr. 18, 1958. 10p.

Preliminary values have been obtained for the thermal conductivity of commercial nickel at temperatures up to 200°C. Necessary changes in the apparatus and experimental procedure are indicated. A modified apparatus for materials of low conductivity is described. (auth)

10623 SCTM-163-58(16)

Sandia Corp., Albuquerque, N. Mex.

AN EVALUATION OF ULTRASONIC SOLDER JOINTS. D. W. Grobecker and J. B. Duran. Apr. 23, 1958. 12p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

A comparison is made between joints soldered by ultrasonic methods and specimens soldered by the usual hot iron and flux technique. Test samples of mild steel, copper, aluminum, and stainless steel joined with tin–lead and tin–zinc alloys are compared. Ultrasonic soldering techniques appear to offer an advantage in joining aluminum alloys with tin–zinc solder and copper alloys with tin–lead solder without the utilization of a fluxing addition. However, the mechanical characteristics of tin–zinc soldered joints are degraded by a humidity exposure. (auth)

10624 TID-8018

Technical Information Service, AEC.

SOLDERING OF URANIUM. G. S. Hanks, D. T. Doll, J. M. Taub, and E. L. Brundige, [Los Alamos Scientific Lab.]. [1957?]. Decl. Sept. 23, 1957. 18p. $0.50(OTS).

Originally issued as AECD-4247.

One of Its Monograph Series, "The Industrial Atom."

The joining of uranium to uranium has been done successfully using a number of commercial soft solders and fusible alloys. Soldering byusing an ultrasonic soldering iron has proved the best method for making sound soldered joints of uranium to uranium and of uranium to other metals, such as stainless steel. Other methods of soldering have shown some promise but did not give reliable joints all the time. The soldering characteristics of uranium may best be compared to those of aluminum. (auth)

10625 TID-8019

Technical Information Service, AEC.

WELDING THIN-WALLED URANIUM CYLINDERS. E. L. Brundige, J. M. Taub, G. S. Hanks, and D. T. Doll, [Los Alamos Scientific Lab.]. [1957?]. Decl. Sept. 24, 1957. 14p. $0.50(OTS).

One of Its Monograph Series, "The Industrial Atom."

The development of a satisfactory process for the fusion welding of thin-walled uranium cylinders is discussed. Optimum results were obtained using the inert-gas shielded-arc method without the use of filler metal. The ductility of the welded joints, however, was lower than that of cast metal. Surface conditions and and the purity of the inert gas used affected the weld soundness. Straight polarity direct current was used for welding to achieve maximum penetration and to provide arc stability. Welding must be done in the flat position. (auth)

10626 TML-92

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus Ohio.

THE ENGINEERING PROPERTIES OF COMMERCIAL TITANIUM ALLOYS. M. W. Mote, R. B. Hooper, and P. D. Frost. June 4, 1958. 233p. Contract AF18(600)-1375.

The general composition and designation of Ti alloys, properties of commercial alloys of Ti in annealed and heat-treated conditions, and data on the uniformity of the alloys are discussed. Information for designers and users of aircraft structural materials as applied to Ti is given. (W.L.H.)

10627 TML-100

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

HYDROGEN IN TITANIUM AND TITANIUM ALLOYS.

Dean N. Williams. May 16, 1958. 113p. Contract AF18(600)-1375.

Research devoted to the attainment of a more complete understanding of the behavior of hydrogen in titanium and titanium alloys is reviewed and correlated. The factors of most significance are the temperature dependence of hydrogen solubility in alpha and beta titanium, hydrogen partial pressure, and alloy composition. These factors control absorption, embrittlement, degassing, and many other phenomena observed in hydrogen-containing titanium alloys. Information that has become available during the past few years permits a fairly complete discussion of these factors now. Many effects that were difficult to understand previously are seen to be related to such things as, for example, changes in hydrogen solubility in beta due to alloying. (auth)

10628 TML-104

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

ADHESIVE BONDING OF TITANIUM. H. E. Pattee, G. E. Faulkner, and P. J. Rieppel. June 13, 1958. 28p. Contract AF18(600)-1375.

A summary of the available information on the adhesive bonding of titanium is presented. 85 references. (W.L.H.)

10629 WAPD-PWR-PMM-1840

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

OUTLINE OF PWR ALTERNATE CONTROL MATERIAL INFORMATION OBTAINED AT BETTIS. Feb. 15, 1958. 25p. $4.80(ph OTS); $2.70(mf OTS).

In evaluating Cd–In–Ag for Shippingport Pressurized Water Reactor control rods the following data resulted: tensile properties of powder metal control rod at 550 and 600°F; reactivity of irradiated wrought alloy; corrosion of extruded powder metal in water at 500 to 650°F; and creep rupture at 550 and 600°F for extruded and annealed alloy. (T.R.H.)

10630 WAPD-T-550

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

SLIDING FRICTION OF PREFERRED BEARING MATERIALS IN PRESSURIZED WATER ENVIRONMENTS. N. B. Dewees. Apr. 1957. 19p. Project 90296. Contract [AT-11-1-GEN-14] and NObs 67500. $3.30(ph OTS); $2.40(mf OTS).

The coefficient of friction of loosely guided parts in demineralized water exposed to the atmosphere and at room temperature is shown to vary over a wide range. Repeat tests with closely guided parts in a similar environment and in 500°F, demineralized, oxygenated water show that the coefficient of friction varies over about the same range. The materials investigated are the stainless steels, cobalt-base alloys, nitrided stainless, chromium plate, and a few others. (auth)

10631 WAPD-ZH-7

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

ZIRCONIUM HIGHLIGHTS. May 1958. 27p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

The dilatometric investigation of the $\alpha + \beta$ region temperature limits for vacuum-melted Zircaloy-2 is presented. An attempt was also made to obtain reproducible results for the temperatures of transformation $\alpha \rightarrow \alpha + \beta$ and $\alpha + \beta \rightarrow \beta$ on heating and cooling as a function of the rate of heating and the heat treating history. The status of the cost reduction program in Zircaloy-2 ingot melting is presented. Rate equations are presented for the dehydriding of Zircaloy-2 by vacuum-annealing. (For preceding period see WAPD-ZH-6.) (W.L.H.)

10632 AEC-tr-3261

ON THE STRUCTURAL PECULIARITIES OF MOLTEN ALLOYS IN CERTAIN BINARY SYSTEMS. D. K. Belashchenko. Translated by S. J. Rothman (Argonne National Lab.) from Doklady Akad. Nauk S.S.S.R. 117, 98-101(1957). 5p.

The coordination structure of liquid binary alloys was investigated by measuring viscosity and electric conductivity of the following systems: Sb–Sn, Cd–Sb, Cd–Cu, Pb–Tl, Bi–Tl, and Fe–Ni. Certain rules were established describing the influence of electron concentration on the properties of liquid alloys, the connection between their thermodynamic and kinetic properties, and the relationships between the structures of the liquid and solid alloys. (T.R.H.)

10633 AEC-tr-3262

THE INFLUENCE OF COPPER AND ALUMINUM ADDITIONS ON THE TEMPERATURE DEPENDENCE OF THE ANISOTROPIC SELF-DIFFUSION COEFFICIENT IN SINGLE CRYSTALS OF ZINC. I. A. Naskidashvili. Translated by S. J. Rothman (Argonne National Lab.) from Soobshcheniya Akad. Nauk Gauzin. S.S.R. 16, 509-16(1955). 9p.

Experiments are described which led to the following conclusions: The anisotropy of self-diffusion in pure Zn was quite large at low temperatures but became smaller near the melting point. The self-diffusion rate in Zn increases monotonically in both directions with increasing Cu concentration. The addition of Cu significantly decreased the anisotropy of self-diffusion in Zn. Introduction of Al into the Zn–Cu solid solutions led to a decrease of the Zn self-diffusion rate in both directions. Increasing the Al content had no effect on the anisotropy of the self-diffusion coefficient. The experimental data can be correlated with the geometrical changes of the unit cell caused by the dissolution of Cu and Al atoms. (auth)

10634 AEC-tr-3269

MECHANISM OF DIFFUSION IN HARD METALS. I. L. Mirkin. Translated from Tsentral''Nauch.-Issledovatel' Inst. Tekhnol. i Mashinostroen. No. 79, 5-24 (1957). 34p.

A summary of some of the basic aspects of the problems of diffusion is given by analyzing theoretical accounts and experimental data. An attempt is made, on the basis of the findings, to define the nature of the phenomenon, its mechanism and basic characteristics. The process of diffusion is indicated to be a cooperative displacement of a group of atoms entering consecutively into a state analogous to a liquid state. (T.R.H.)

10635

PROBLEMS IN SIMULTANEOUS HEAT-HARDENING AND CERAMIC COATING OF NO. 420 STAINLESS STEEL. Edward L. Bradley (Georgia Inst. of Tech., Atlanta). Am. Ceram. Soc. Bull. 37, 222-6(1958) May.

Problems encountered during efforts to simultaneously heat treat and porcelain enamel No. 420 stainless steel are reviewed. It is shown that the cooling contraction curve for the metal can be useful in determining the optimum softening point which its enamel coating should possess. Recommendations are given for future investigators who might encounter the same problems met in this study. (auth)

10636

PRODUCTION OF MALLEABLE NIOBIUM. O. P. Kolchin, N. V. Sumarokova, and N. P. Chuveleva. Atomnaya Energiya 3, 515-24(1957).

Reduction of K_2NbF_7 with sodium yields niobium powder with a niobium content of 98.9 to 99.2%. Malle-

able niobium is obtained by pressing the powder into bars and sintering the bars in a vacuum. An investigation of the reduction and sintering processes shows that the main reaction in the vacuum reduction can be described as a summation reaction of successively occurring reactions in the following form: $Nb_2O_5 + 5\ NbC \xrightarrow{<1200^\circ C} 2\ NbO_2 + 5$ "NbC" ($NbC_{0.8}$) + CO ("NbC" is a phase with variable composition); $2\ NbO_2 + 5$ "NbC" $\xrightarrow{\sim 1200^\circ C} 0.5\ NbO_2 + 1.5\ NbO + 2.5\ Nb_2C + 1.5\ CO$; $0.5\ NbO_2 + 1.5\ NbO + 2.5\ Nb_2C \xrightarrow{\sim 1400^\circ C} 2\ NbO + 2\ Nb_2C + Nb + 0.5\ CO$; $2\ NbO + 2\ Nb_2C + Nb \xrightarrow{<1400^\circ C} 7\ Nb + 2\ CO$. Investigations show that in the choice of the reduction procedure the interactions between the vapors of the lowest niobium oxide and the niobium carbides are very important. Niobium of ≥99.98% purity can be obtained by simultaneous carbide reduction and sintering. (J.S.R.)

10637

THERMODYNAMICAL SIMILARITY AND THE VISCOSITY OF FUSED METALS. A. N. Solov'yev. Atomnaya Energiya 3, 550-2(1957).

An attempt was made to find a relationship between the thermodynamic and physical properties of a number of elements. The viscosity of fused Na, K, Li, Ru, Cs, Sn, Hg, Sb, Bi, and Ga was plotted against temperature. The curves fell into two groups, one for the alkali metals and the other for the rest of the metals. The hypothesis is made that the physical properties of similar metals could be deduced if the physical properties of one were accurately known. (J.S.R.)

10638

CALCULATED AND OBSERVED EFFECTS OF TEXTURE ON THE MAGNETIC PROPERTIES AND YOUNG'S MODULUS OF NICKEL SHEET. E. R. W. Jones, C. A. Clark, and E. A. Fell (Mond Nickel Co., Ltd., Birmingham, Eng.). Brit. J. Appl. Phys. 9, 178-84(1958) May.

Relative values of Young's modulus, magnetostrictive coupling coefficient, and initial and maximum permeabilities are calculated for various textures in nickel, an approximate model being used for magnetic properties. Experimental values are given for high purity polycrystalline nickel sheet produced by powder metallurgy and annealed in purified hydrogen. Comparison between theory and experiment indicates good agreement for Young's modulus and fair agreement for magnetic properties. The textures were determined by X-ray photographic techniques and it was shown that strip possessing a cube recrystallized texture gave lower properties than recrystallized strip having a random grain orientation. It was also found, in agreement with previous work on copper, that the perfection of the cube texture was mainly governed by the temperature of anneal. (auth)

10639

NEW ALLOY STEELS BEAT PROCESS BUGABOOS. II. D. B. Roach and A. M. Hall (Battelle Memorial Inst., Columbus, Ohio). Chem. Eng. 65, No. 11, 134, 136, 138(1958) June 2.

A new group of stainless steels, known as precipitation-hardening steels, holds great promise in chemical process applications. The steels, combining high strength with corrosion resistance, are produced by a simple heat treatment. The steels contain elements such as Al, Cu, and Mo, which precipitate during the hardening treatment and combine the good corrosion resistance of the 17% Cr, 7% Ni type 301 stainless with strength properties of the 400 series. (auth)

10640

ON DIFFUSION-FREE CRYSTALLIZATION OF METAL ALLOYS. V. M. Glazov and V. N. Vigdorovich (Baikov Inst. of Metallurgy). Doklady Akad. Nauk S.S.S.R. 118, 924-7(1958) Feb. 11. (In Russian)

The combined influence of the cooling rate and alloy composition on the degree of dendrite branching in crystallization was studied, considering two possible types of component interactions. The investigation considered the dendrite branching in the initial crystallization of systems forming the limited areas in solid solutions. The maximum microhardness of solid solution crystals of Al–Si, Al–Cu, and Al–Fe annealed after casting at 400° was found to be the maximum point of their heterogeneity and consequently the highest degree of dendrite branching for alloys in the melted state. (R.V.J.)

10641

CHROMIUM VAPOR PRESSURE OVER SOLID CHROMIUM–IRON ALLOYS. E. Z. Vintaikin (Central Research Inst. of Iron Metallurgy). Doklady Akad. Nauk S.S.S.R. 118, 977-9(1958) Feb. 11. (In Russian)

The chromium vapor pressure over chromium–iron alloys was measured in the temperature range 1100° to 1400°C to determine the thermodynamic functions of the solutions. The Knudsen effusion method with radiometric determination was used to evaluate the quantity of chromium condensed on targets. Electrolytic iron and chromium (the latter containing Cr^{51}) were melted in alundum crucibles in a helium atmosphere. The results obtained for chromium vapor pressure were in good agreement with the published data. A diagram is given of the thermodynamic activity of iron–chromium alloys at 1667°K. The thermal sublimation and partial heats of chromium solubility are tabulated. The critical dissociation temperature is 600°C. The embrittlement as a factor of cleavage was found at 475°C. Consequently, it was assumed that the solid α solution can convert into σ phase or dissociate into two solid solutions. (R.V.J.)

10642

AN EXPERIMENTAL STUDY OF THE LOADING FUNCTION FOR NICKEL SPECIMENS PLASTICALLY PRESTRAINED BY TENSION. Yu. I. Jagn and O. A. Shishmarev. Doklady Akad. Nauk. S. S. S. R. 119, 46-8(1958) Mar. 1. (In Russian)

10643

THE PROCESS OF CARBIDE FORMATION IN STEEL TEMPERING AS RELATED TO REVERSIBLE BRITTLENESS. L. M. Utevskii (Central Research Inst. of Ferrous-Metal Metallurgy). Doklady Akad. Nauk S.S.S.R. 119, 79-82(1958) Mar. 1, (In Russian)

10644

STATIC AND CYCLIC STRENGTH OF METALLOCERAMIC HARD ALLOYS CONSISTING OF TUNGSTEN CARBIDE AND COBALT. G. S. Kreymer, A. I. Baranov, and O. S. Safonova. Fiz. Metal. i Metalloved. 5, 361-4 (1957). (In Russian)

The cyclic strength of cobalt–tungsten carbide systems was studied as a function of the thickness of the cobalt interlayers and as a function of the plasticity. The tests consisted of bending rotating specimens which were fixed on one side. The tests were based on five million loading cycles. The results are tabulated and confirm the view that the reduction in plasticity of the cobalt interlayers with a decrease in thickness leads to a decrease in the strength and thus also to a decrease in the strength of the material as a whole. (J.S.R.)

10645
DESCRIBE BRAZING FILLER METALS FOR HIGH-TEMPERATURE SERVICE. Ind. Labs. 9, No. 6, 74-5 (1958) June.

A description of brazing filler materials used for high-temperature service is presented. Properties and suggested uses of silver–copper–lithium, silver–palladium, manganese–nickel, chromium–nickel–silicon–boron, and gold–chromium–nickel alloys are presented. (J.R.D.)

10646
CRACK-FREE ALLOYED JUNCTIONS IN SILICON USING PURE ALUMINUM. Theodore C. Taylor (Raytheon Mfg. Co., Waltham, Mass.). J. Appl. Phys. 29, 865-6(1958) May.

A method has been developed for the preparation of crack-free aluminum–silicon fused junctions in semiconductor-grade single crystal silicon. Details of the welding technique are presented. (A.C.)

10647
HIGH-BORON ALLOY STEELS. T. H. Middleham, J. R. Rait, and E. W. Colbeck (Hadfields, Ltd., Sheffield, Eng.). J. Brit. Nuclear Energy Conf. 3, 116-35(1958) Apr.

The discovery of a new technique for the production of boron-iron alloys containing up to 4.75% boron which can be successfully forged, rolled, and extruded, and boron-iron alloys up to 6% boron which can be successfully produced in the form of castings is described. The methods of manufacture, physical and mechanical properties, and constitution of these boron steels are described as well as their applications in thermal nuclear reactors. (W.D.M.)

10648
THE COMBUSTION OF ZIRCONIUM IN OXYGEN. W. L. Doyle, J. B. Conway, and A. V. Grosse (Temple Univ., Philadelphia). J. Inorg. & Nuclear Chem. 6, 138-44(1958) Apr.

The combustion of zirconium in oxygen leads to one of the highest temperatures obtainable by the combustion of metals. This temperature has been estimated from available thermodynamic data to be 4930°K at 1.0 atm pressure. A technique has been developed which enables a powdered zirconium–oxygen flame to be operated, thus producing the highest metal flame temperature reported to date. (auth)

10649
BERYLLIUM: PRESENT AND POTENTIAL USES. Lawrence F. Boland (Beryllium Corp., Reading, Penna.). J. Metals 10, 401-3(1958) June.

A general run down of the Be industries advance in the past few years is presented. The production, cost, availability, ductility, and toxicity of Be is also included. (W.L.H.)

10650
PH STAINLESS FOR HOT AIRFRAMES. R. W. White. Metal Progr. 73, No. 6, 74-8(1958) June.

The properties, fabrication methods, and uses of precipitation hardening stainless steels are discussed including the processing steps used at Chance Vought Aircraft for 17-7 pH (armco). (J.R.D.)

10651
MATERIALS FOR ROCKET ENGINES. R. C. Kopituk (Reaction Motors, Inc., Denville, N. J.). Metal Progr. 73, No. 6, 79-84(1958) June.

The components of rocket engines are discussed, pointing out that these are subject to high temperatures and stresses, and that fuels are often corrosive. Selection and fabrication of materials for regenerative and nonregenerative rocket engines are discussed. (J.R.D.)

10652
CAN AN IMPROVED NONAGING STEEL BE PRODUCED COMMERCIALLY?. Eric R. Morgan (Jones and Laughlin Steel Corp., Pittsburgh). Metal Progr. 73, No. 6, 88-94(1958) June.

Quench and strain aging in steel are described and methods of restricting these phenomena are considered. Careful coordination of chemical composition, precise annealing, and special temper rolling techniques are thought to be the keys to improvement of nonaging steel. (J.R.D.)

10653
ON THE DIAGRAMS OF STATE OF THE SYSTEM CHROMIUM–NIOBIUM. V. N. Yeremenko, G. V. Zudilova, and L. A. Gayevskaya. Metalloved. i Obrabotka Metal. No. 1, 11-16(1958). (In Russian)

Molten alloys of chromium and niobium were produced in a high-frequency furnace under a protective argon atmosphere from powders of electrolytic chromium and niobium with particle sizes from 1 to 5 μ. The resulting alloys were examined by thermal, metallographic, and x-ray analysis. It was found that in the chromium–niobium system only one intermetallic compound $NbCr_2$ is formed. It has a face-centered cubic lattice. The intermetallic compound forms eutectics with chromium-base and niobium-base solid solutions. The temperature of eutectoid crystallization of the intermetallic compound with the chromium-base solid solution is 1660°C (with a niobium content of 31 wt. %). The second eutectic point is at 1710°C at a niobium content of 66 wt. %. Primary solid solutions with a niobium base and a chromium base are formed. The solubility of niobium in chromium at 1350°C is about 3 wt. %. Long duration annealing at 1350°C coarsens the components of the eutectic, and after 100 hours the structure does not have a eutectoid character. Alloys of chromium with niobium can be obtained by sintering inside a protective atmosphere at 1550°C. Complete recrystallization occurs, and an equilibrium state is reached by sintering for 2 to 5 hours at 1550°C. (J.S.R.)

10654
FORTY YEARS OF POWDER METALLURGY IN THE SOVIET UNION. M. Yu. Bal'shin and G. V. Samsonov. Metalloved. i Obrabotka Metal. No. 12, 15-25(1957).

10655
RECRYSTALLIZATION PROCESSES IN NICKEL ALLOYS. M. Ye. Blanter and L. I. Kuznetsov. Metalloved. i Obrabotka Metal. No. 12, 31-6(1957).

The effect of Mo, Cr, Ti, and Co on the process of softening, recovery, and recrystallization in binary nickel-base alloys was studied. The specimens were deformed at room temperature, and the recrystallization process was investigated by metallographic analysis and the hardness method. The results are graphed, and the mechanism of recrystallization is discussed. (J.S.R.)

10656
SURFACE HARDENING OF TITANIUM BY TREATMENT IN MOLTEN BORAX. A. N. Minkevich and Yu. N. Shul'ga. Metalloved. i Obrabotka Metal. No. 12, 53-61(1957).

The surface hardening of titanium and titanium alloys by treatment in molten borax was investigated. Commercial titanium, a titanium–tungsten alloy, and an aluminum–chromium–titanium alloy were used for the experiments. To prevent oxidation of the titanium and to protect the surface, electro-chemical protection was

applied, the current density being 0.1 amp/cm² and the voltage 12 to 15 v. After removal from the molten bath, the specimens were coated with a thin layer of borax. The results showed that treatment in molten borax is an effective method of increasing surface hardness. However, the strength, malleability, and toughness of the titanium and alloys were reduced. The mechanism of the hardness increase is discussed. (J.S.R.)

10657

FINE ALUMINIUM NITRIDE PRECIPITATES IN STEEL. C. C. Hsiao (Univ. of Minnesota, Minneapolis). Nature 181, 1527-8(1958) May 31.

An electron microscope was employed in an attempt to identify and separate fine aluminum nitride particles from a sample of nitrided vacuum-melted steel. (C.H.)

10658

ELECTRODE-TIP LIFE STUDIES IN SERIES SPOT WELDING. E. F. Nippes, W. F. Savage, S. M. Robelotto, and K. E. Dorschu (Rensselaer Polytechnic Inst., Troy, N. Y.). Welding J. (N. Y.) 37, 241s-8s (1958) June.

The effects of electrode geometry, material, force, and welding current on weld strength, diameter, consistency, and electrode life were investigated. As a result, an optimum combination of welding variables was determined. A study of the effect of electrode geometry on weld consistency indicated that a 2-in. continuous-radius domed electrode provided more consistent welds than the $^5/_{16}$-in. continuous-radius dome often used in commercial practice. An additional study demonstrated that welding conditions which did not produce flashing at the electrodes provided more consistent welds than welding conditions which caused flashing. (auth)

10659

BONDING OF CERMET-VALVE COMPONENTS TO METALS. G. M. Slaughter, P. Patriarca, and W. D. Manly (Oak Ridge National Lab., Tenn.). Welding J. (N. Y.). 37, 249s-54s(1958) June.

The techniques and procedures utilized to bond cermet-valve components successfully to metals for high-temperature fluid service are described. The carmets studied contained varying percentages of titanium carbide, tungsten carbide, tungsten-titanium complex carbide and niobium-tantalum-titanium complex carbide. The binder materials were primarily nickel and cobalt. The results of wetting tests on these cermets with different brazing alloys are presented, as are photomicrographs of many of the most promising cermet-to-metal joints. A procedure for attaching cermets is described wherein a nickel or tungsten-base alloy cushion is brazed between the cermet and Inconel to absorb stresses resulting from differential thermal expansion. A direct high-temperature bonding procedure is also discussed in which cermets of the titanium carbide-nickel type are joined to nickel without the use of a separately applied brazing alloy. (auth)

10660

THE ARC WELDING OF WROUGHT MAGNESIUM–THORIUM ALLOYS. L. F. Lockwood and Paul Klain (Dow Chemical Co., Midland, Mich.). Welding J. (N. Y.). 37, 255s-64s(1958) June.

Results of welding evaluation tests on the recently developed, wrought, magnesium-base, thorium-containing alloys are presented. These alloys possessed excellent weldability and retained high strengths at elevated temperatures after welding. The strengths of the welds were equal to, or closely approached, the strengths of the base metals at elevated temperatures. The creep resistance of the alloys was not adversely affected by welding. Postweld heat treatments did not improve the weld strength to any marked degree. The corrosion rates in 3% NaCl solution were not changed significantly by welding. (auth)

10661

SPOT WELDING OF INCONEL "X" IN THICKNESS RANGE OF 0.032 TO 0.188 IN. Jean Harris and J. J. Riley (Taylor-Winfield Corp., Warren, Ohio) and M. D. Bellware (International Nickel Co., Inc., New York). Welding J. (N. Y.) 37, 570-8(1958) June.

Recommended welding schedules are outlined for spot welding Inconel "X" sheets of 0.032-, 0.062-, 0.093-, 0.125-, 0.143-, 0.156-, and 0.188-in. thicknesses. The weld quality meets the requirements of Military Specification MIL-W-6858A. The work was performed on several sizes of welding machines which included the three-phase dry-disk rectifier type and single-phase type. The basic approach was to formulate two sets of schedules, one using high welding pressure and the other lower pressure. The welding technique was developed as required to produce sound welds for each condition. The interdependent variables are discussed with respect to their influence on weld strength and weld soundness. The results indicate that satisfactory welds can be made on either three-phase or single-phase equipment. It is not necessary to use high values of weld force if the geometric shape of the product makes adequate tooling design impossible. (auth)

10662

ELEMENTS OF JOINT DESIGN FOR WELDING. K. H. Koopman (General Electric Co., Schenectady, N. Y.). Welding J. (N. Y.) 37, 579-88(1958) June.

The design of joints which are to be fusion welded by any of the arc or gas processes is discussed. The designs are applicable to either manual or machine welding. (A.C.)

10663

POROSITY IN ALUMINIUM ALLOY WELDS. F. R. Collins (Aluminum Co. of America, New Kensington, Penna.). Welding J. (N. Y.) 37, 589-93(1958) June.

The greatest source of porosity in aluminum-alloy welds is atmospheric contamination of the shielding gas. Hydrogen, formed by the reaction of water vapor with molten aluminum, is responsible for nearly all porosity. The use of a helium-argon-mixture shielding gas is recommended to reduce porosity. Excessive hydrogen in aluminum-alloy plate and electrode can contribute to porosity; but, in general, commercial aluminum products do not contain sufficient hydrogen to make a substantial contribution to porosity. Aluminum-magnesium alloys give less porosity than aluminum-magnesium-silicon alloys. Oxygen and chlorine additions to argon reduce porosity but have disadvantages that make them undesirable for most applications. (auth)

10664

ON THE METHOD OF INVESTIGATING THE TENDENCY TO DEFORMATION OF METALS AT HIGH TEMPERATURES. Ye. I. Bel'skiy and P. I. Tomilin. Zavodskaya Lab. 23, 957-8(1957).

The paper suggests the use of a device which permits tests at a temperature of 1350°C with the use of a pendulum ram and a silicon carbide furnace. (J.S.R.)

10665

LABORATORY VACUUM FURNACE FOR TEMPERATURES OF 2000–2500°. A. G. Tyutyunik. Zavodskaya Lab. 23, 1126-7(1957). (In Russian)

A vacuum furnace with a tungsten heater is described.

The essential advantages offered by this furnace are the lack of ceramics in the high temperature zone, and an efficacious screening system which makes it possible to attain high temperatures in a large volume with a relatively low power consumption. The furnace was tested for a year in the laboratory and is recommended for investigations carried out at high temperatures. A detailed description of the furnace is given. The furnace may be used in any chamber in which the vacuum is not less than 1×10^{-4} mm torr. Basic investigations of metal were carried out in a vacuum of the order of 10^{-5} to 10^{-7} mm torr. The vacuum system consists of a vacuum pump, a diffusion oil pump with 1000 l/sec, and a vacuum metal chamber with 200 l contents and water cooling. (TCO)

10666

HEAT EFFECTS IN THE SYSTEM LEAD–TIN–BISMUTH ON MELTING. III. CALCULATION OF THE HEATS OF PHASE TRANSITION FOR TERNARY METALLIC ALLOYS. R. B. Gershman (Kharkov State Univ.). Zhur. Fiz. Khim. 32, 258-61(1958) Feb. (In Russian)

Calculations have been made with configurational approximation, correlating the heats of phase transitions of ternary alloys with the heats of melting of the pure components and the concentrations and energies of mixing of the alloys. Comparisons of theoretical equations for the heats of phase transitions with the experimental data for the system lead–tin–bismuth show that the formulas hold for the entire concentration range of the given system. The energy constants of the ternary system lead–tin–bismuth were determined. (tr-auth)

10667

X RAY DETERMINATION OF THE HETERODIFFUSION COEFFICIENT IN ALLOY COMPONENTS WITH SHARP DIFFERENCES IN THE ABSORPTION OF X RADIATION. B. Ya. Pines and I. V. Smushkov (Gor'kii State Univ., Kharkov). Zhur. Tekh. Fiz. 28, 661-7(1958) Mar. (In Russian)

Analyses were made of inverse radiograms for binary alloys with varying concentrations in depth and with components of different x-ray absorption coefficients, μ, and deflection powers. An equation was developed connecting the x-ray intensities reflected from the layer to the concentration and the depth of the layer. The equation can be solved by a system of approximations with the initial approximation coming close to the true curve. The relationship of the concentration distributions and the magnitudes of the gradient concentrations to the depth were found. The obtained values permitted the evaluation of the heterogeneous coefficients in relation to the concentrations. Calculations of the function for Cr–Mo alloy are included. (tr-auth)

10668

X RAY DETERMINATION OF THE HETERODIFFUSION COEFFICIENT IN THE SYSTEMS Cr–Mo AND Ni–W. B. Ya. Pines and I. V. Smushkov. Zhur. Tekh. Fiz. 28, 668-73(1958) Mar. (In Russian)

A series of massive molybdenum and tungsten specimens coated with thin layers of chromium and nickel respectively were treated by diffusion annealing at various temperatures. Radiographic studies followed the treatment and calculations of photometric curves were made according to formulas previously developed. Distributions of concentrations and gradient concentrations in the alloys resulting from the diffusion were determined and diffusion coefficients for various temperatures were evaluated. The activation energy and pre-exponential multiplier values were determined. (tr-auth)

10669

CONSTITUTION OF BINARY ALLOYS. SECOND EDITION. Max Hansen. New York, McGraw-Hill Book Company, Inc., 1958. 1321p. $32.50.

A revision and translation of an earlier German work is presented concerning phase diagrams of binary alloys and crystal structure of metallic phases including symmetry of the intermediate phases and lattice spacings. 1286 systems arranged alphabetically by constituent elements are included, and 684 phase diagrams in atomic per cent are presented with tables and factors for conversion. (J.R.D.)

10670

EFFECT OF ALLOYING ELEMENTS ON THE TEMPER BRITTLENESS OF STRUCTURAL STEELS. V. I. Prosvirin and Ye. I. Kvashinina. Term. Obrabotka i Svoystva Litoy Stali. M., Mashgiz. 69-87(1955). (Translated from Referat. Zhur. Fiz. No. 3, 1957, Abstract No. 6655.)

10671

THE FABRICATION OF STAINLESS STEEL–UO_2 FUEL PLATES. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 38, Session 28. W. R. Weinberger and H. S. Kalish (Sylvania-Corning Nuclear Corp., Bayside, N. Y.). New York, American Institute of Chemical Engineers, 1958. 19p.

Stainless steel-UO_2 fuel plates composed of various types of stainless steel and of UO_2 concentrations up to 30 wt.% have been satisfactorily fabricated. In order that this goal might be attained, it was necessary that the effects on the properties of core compacts of use of various particle sizes of both stainless steel and UO_2 powders be fully evaluated. Also, it was essential that the proper blending and compacting conditions necessary to yield compacts having the best possible properties for their handling and for the production of high-quality plates be determined. In addition, the effects of sintering upon core compacts were evaluated. Additional work carried out consisted of the development of an economical fabrication process which would yield high-quality fuel plates. Various pre-heat and hot rolling temperatures were investigated along with varying hot and cold reductions, and various annealing cycles. (auth)

10672

METALLURGICAL DESIGN AND PROPERTIES OF SILVER–INDIUM–CADMIUM ALLOYS FOR PWR CONTROL RODS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 19, Session 8. I. Cohen, E. F. Losco, and J. D. Eichenberg (Westinghouse Electric Corp., Pittsburgh). New York, American Institute of Chemical Engineers, 1958. 38p.

The metallurgical design and properties of recently developed silver–indium–cadmium alloys are discussed. These alloys show considerable promise of fulfilling metallurgy, physics, and mechanical design requirements of control rods for PWR (Pressurized Water Reactor). By extension of the Hume-Rothery electron concentration rule, ternary and quaternary Ag-base alloys were designed for metallurgical stability and their properties determined. Of particular interest is a Ag–15 wt.% In–5 wt.% Cd alloy which is comparable to hafnium in neutron absorption characteristics. The alloy, a single-phase solid solution, is designed to be dimensionally stable under prolonged exposure at reactor operating conditions. Its corrosion resistance in pressurized water of varying chemistry was explored in the temperature range of 500 to 650°F and found to be remarkably high, thus permitting its operation without

protective cladding. Physical and mechanical properties are described. Yield strength is lower than that of hafnium but entirely adequate for industrial power reactors. The alloy is quite ductile and can be easily fabricated by usual forging, rolling, and extruding techniques. Properties of full-size Ag–15 wt.% In–5 wt.% Cd PWR-type control rods are discussed. (auth)

10673

STRENGTH OF METAL–CERAMIC HARD ALLOYS OF TUNGSTEN CARBIDE AND COBALT. P. S. Kreymer. Poroshkovaya Metallurgiya, Yaroslavl' 115-26(1956). (Translated from Referat. Zhur. Fiz. No. 3, 1957, Abstract No. 6815.)

10674

ZIRCONIUM. METALLURGY OF THE RARER METALS. 2. Second Edition. G. L. Miller. New York, Academic Press, Inc., 1957. 569p.

The methods for the production of Zr metal are divided into three sections, each occupied by one chapter. The various melting techniques employed in the metallurgy of Zr are described in detail. The properties of the metal are detailed, and a chapter is devoted to the reactions of Zr with the common gases. The outstanding property of Zr–its resistance to chemical corrosion–is discussed at length. The fabrication and mechanical properties of various Zr alloys are discussed in detail. (W.L.H.)

PHYSICS

10675 58-RL-1947

General Electric Co. Research Lab., Schenectady, N. Y.

SHAPE-PRESERVING SOLUTIONS OF THE TIME-DEPENDENT DIFFUSION EQUATION. F. S. Ham. Apr. 1958. 16p.

Exact solutions to the time-dependent diffusion equation are exhibited which correspond to the diffusion-limited growth of ellipsoidal precipitate particles with constant shape and dimensions proportional to the square root of the time. The asymmetry of the diffusion field in these solutions is consistent with the preservation of the particle's shape during growth, even if the diffusivity is anisotropic. Limiting cases for simpler geometries are derived and shown to be in agreement with previously known results for radially symmetric particles and isotropic diffusion. Similar solutions for hyperboloidal surfaces are exhibited, and generalizations are considered analogous to those discussed by Danckwerts for one-dimensional diffusion. (auth)

10676 AD-137082

Brown Univ., Providence.

LIMIT ANALYSIS OF CYLINDRICAL SHELLS USING APPROXIMATE YIELD CONDITIONS. Technical Report No. 2. H. Cohen and R. T. Shield. Mar. 1958. 32p. Project No. DA-599-01-004. Contract DA-19-020-ORD-4564.

The theorems of limit analysis are used to obtain close bounds for the limit loading in some problems of symmetrically loaded cylindrical shells. It is shown that a parabolic prism approximation to the exact yield surface is a more useful approximation than the sandwich shell polyhedron surface when appreciable axial force is present. (auth)

10677 AFOSR-TN-58-195

Illinois. Univ., Urbana. Electrical Engineering Research Lab.

HALL EFFECT MEASUREMENTS ON SOME ALKALI EARTH TITANATES. Technical Note No. 11. E. K. Weise and M. C. Andrews. Jan. 1, 1958. 24p. OSR Project No. 52-670A-85. Contract AF33-038-12644. (AD-152228).

Measurements of the Hall effect on sintered samples of Mg_2TiO_4, $MgTiO_3$, $MgTi_2O_5$, $CaTiO_3$, $SrTiO_3$, and $BaTiO_3$ were made. Mobility and concentration of electrons were determined and compared with data obtained from resistivity measurements. Approximate values of the electron mobility in cm^2/v sec as derived from the Hall effect data were as follows: 0.3 for $CaTiO_3$; 3.0 for $SrTiO_3$; 0.1 for $BaTiO_3$. The values for the magnesium titanates are still lower, between 0.01 and 0.1. The equipment used is briefly described. (auth)

10678 BRL-TN-843

Ballistic Research Labs., Aberdeen Proving Ground, Md.

PRELIMINARY INVESTIGATION OF THE SHOCK WAVE PROPAGATED FROM THE OPEN END OF A CYLINDRICAL SHOCK TUBE. Leonard P. Grady and Glenn P. Beichler. Jan. 1954. 18p. DA Project No. 503-04-002. (AFSWP-768).

Belief that similarities exist between a shock wave from a free-air explosion and a shock wave propagated from the open end of a cylindrical shock tube formed the basic assumption to be tested by this experiment. By means of an array of gages mounted beyond the open end of a shock tube, pressure-time records were obtained. The results indicate a tendency toward formation of a spherical wave front covering a wide solid angle at a distance from the end of the tube. When a pseudo-spherical front has been formed, similarities exist between the positive phase of pressure-time records obtained from free-air explosions and those obtained by this method but durations and pressure decay with distance do not scale with those of free-air explosions. (auth)

10679 CRFD-762

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

A LITERATURE SURVEY ON THE MEASUREMENT OF THERMAL CONDUCTIVITY OF SEVERAL SOLIDS INCLUDING URANIUM DIOXIDE. A. M. Ross. Mar. 1958. 42p. (AECL-585). $1.00(AECL).

A literature search has been made on the measurement of thermal conductivity in order to choose a suitable method for small sintered samples of uranium dioxide at various temperatures. The method must be readily adaptable for remotely controlled measurements on neutron-irradiated samples in a hot-cell facility. The various methods for measuring thermal conductivity at ambient and elevated temperatures have been classified into six steady-state heat flow groups and one transient-state heat flow group. The principle of the method of each group is outlined, and a review of pertinent work in the literature is given. As a result of the survey it is suggested that a comparative heat flow apparatus be developed for measurements on uranium dioxide in vacuum at temperatures up to 1400°C. The comparative heat flow method presently being used should be improved in accuracy and developed for remotely controlled measurements on irradiated samples. A transient-state heat flow comparative method should also be examined. A summary of the published thermal conductivity values for powdered and sintered uranium dioxide is given. An index has been made to provide a source of thermal conductivity data for the many materials covered in the survey. (auth)

10680 HW-53504 B

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE CYPAK BLACK BOX. A. A. Maupin, Jr. May 8, 1958. 17p. Contract [W-31-109-eng-52]. $3.30 (ph OTS); $2.40 (mf OTS).

A detailed explanation of the principle of operation of the basic Cypak building block is presented. Starting with elementary magnetic and electric theory, the Cypak circuit is developed in a logical and straight-forward manner. After the basic device is explained, the modifications necessary to produce the several Cypak logic elements are outlined. (auth)

10681 MLM-CF-58-4-49

Mound Lab., Miamisburg, Ohio.

NUCLEAR BATTERY—THERMOCOUPLE TYPE. Quarterly Progress Report No. 5 [for] January 1, 1958 to March 31, 1958. Bertram C. Blanke. Mar. 31, 1958. 29p. DA Project No. 3-99-15-102. Contract R-65-8-99811-SC-01-91.

A third thermoelectric generator has been constructed and tested. Specifications for batteries having outputs of over six volts at power levels of 30, 50, and 1000 milliwatts at the end of six months have been made. An attempt was made to verify experimentally the theoretical equations of the Thomson and Peltier effects. (For preceding period see MLM-CF-58-1-40.) (auth)

10682 NP-6709

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 28. Apr. 15, 1958. 66p. Contract Nonr-1841(34).

The work on Compton scattering and scattering factors for x rays has been continued with the calculation of the atomic scattering factors for some forty atoms and ions using the SCF atomic wave functions. The results are given as a function of $\sin e/\lambda$ in A^{-1} units. More details are given regarding the electron coupling between nuclear spins in the HD molecule. Combining the use of Gaussian with exponential functions in the study of polyatomic molecules has been suggested. Steady work is going on in the programming of the 704 computer for atomic and molecular calculation, to take the place of the Whirlwind computer. The work on the augmented plane-wave method is beginning to yield results on the energy bands of iron and potassium. The two-vacancy V-center in KCl is discussed. (For preceding period see NP-6556.) (W.D.M.)

10683 NP-6713

New York Univ., New York.

RESEARCH OF FLUORESCENCE AND CONDUCTIVITY PHENOMENA. Quarterly (Final) Progress Report No. 4 for November, December [1957], January [1958]. Hartmut Kallmann. Mar. 1958. 55p. Contract DA-36-039-SC-73145.

The more important features of the process of energy transfer from the solvent to the solute are described. The discussion is often of a qualitative nature because accurate quantitative data are not yet available. It is not impossible, however, to determine the parameters used in these theories more quantitatively using present methods. It appears that there is some intimate connection between infrared and heat in the trap emptying process. Experiments performed to investigate these two mechanisms are described. (For preceding period see NP-6595.) (A.C.)

10684 ORNL-2501

Oak Ridge National Lab., Tenn.

PHYSICS DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING MARCH 10, 1958. June 10, 1958. 88p. Contract W-7405-eng-26. $2.25(OTS).

A new formalism is described which allows the consistent introduction into relativistic quantum theory of a cut-off momentum without use of an arbitrary form factor. Information on the gamma decay characteristics is obtained for the second 2^+ states of W, Os, and Pt nuclei. The total neutron cross sections for C^{12}, C^{13}, and Ne^{21} were measured. The $S^{32}(n,\alpha)Si^{29}$ cross section was measured relative to the fission cross section of U^{238} as a function of incident neutron energy in the range $1.3 < E_n < 3.8$ Mev. Total neutron cross sections were measured for several separated isotopes in the kev energy range with an energy resolution of 3%. The results on Cu^{65} and Fe^{57} are given. Total and scattering neutron cross sections of several elements were measured with the new high-intensity time-of-flight spectrometer. Parameters of resonances up to 300 ev are given for iodine and gold. The spin states of several resonances in W^{183} and silver were determined from scattering and total cross section measurements. Cross sections for (p,n) reactions in cadmium and tellurium isotopes were measured from about 2.5 to 5.5 Mev. Over most of the energy range the cross sections of the isotopes of one element are in constant ratio and increase with mass number. The Cd^{112} threshold was found to be 3.44 ± 0.02 Mev. Absolute cross sections were measured for several (p,n) and (α,n) reactions of light nuclei. A neutron diffraction investigation of MnI_2 was made. The results indicate that MnI_2 is antiferromagnetic, with a Neel temperature of 3.4°K. Neutron diffraction investigations were carried out on $MnCl_2$, metallic cerium, metallic neodymium, $CoCl_2$, and $FeCl_2$ to determine their magnetic properties. The antiferromagnetic structure of MnF_3 was determined and was found to be similar to that in $LaMnO_3$. The magnetic coupling properties are briefly discussed. The energy levels of the configuration $6p^2$ in HgI were investigated. The infrared spectra of PH_2D, PHD_2, and PD_3 was recorded by the multiple-cell compensation technique. A compilation was made of available data on the spectra of Th(IV), Th(III), Th(II), and Th(I), including energy levels and classified lines with Zeeman effects and isotope shifts, as well as certain data on unclassified lines. The present status of knowledge of these spectra is discussed. The role of spectroscopy in thermonuclear research is reviewed briefly. A spherical electrostatic spin rotator is being used to study the polarization of electrons in beta decay. A germanium p-n surface barrier counter was developed which is suitable for α-particle and fission-fragment counting between 1 and 77°K. The Duo-Plasmatron, a new ion source developed in Germany, is discussed. (For preceding period see ORNL-2204.) (W.D.M.)

10685 REIC-7

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

SURVEY OF IRRADIATION FACILITIES. J. F. Kircher. May 31, 1958. 78p. Project 2133. Contract AF33 (616)-5171. (AD-157174).

Reactor facilities, gamma facilities, and high-energy machine sources are included. Wherever possible, the information is tabulated. (auth)

10686 RIB-34

Du Mont (Allen B.) Labs., Inc. Tube Operations-Engineering, Passaic, N. J.

DEVELOPMENT OF PHOTOMULTIPLIER TUBES. Report No. 28 [for] November 1, 1957 to February 1, 1958. F. W. Schenkel, Philip A. Snell, and R. Gauthier.

14p. Contract AT(30-1)-1336. $3.30(ph OTS); $2.40 (mf OTS).

A new resin-type seal was used in the fabrication of an 8-in. flat face tube. Photographs of the emission from this tube are given. A photograph is included which shows the spectral response characteristics of a cesium telluride photosensitive surface. The construction of the sliding system used in the K-1562 phototube is shown. The use of a kovar ring light trap in reducing regeneration in phototubes caused by light feedback is illustrated. Initial performance tests were conducted on the 16-in., 2163-ES, phototube. A photograph of the screen during operation is shown. (For preceding period see RIB-32.) (D.E.B.)

10687 SCR-17

Sandia Corp., Albuquerque, N. Mex.

TUBE DESIGN AND CIRCUIT CONSIDERATIONS FOR FAST-HEATING ELECTRONIC SYSTEMS. K. D. Hardin. June 1958. 20p. Contract AT-(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

Fast-heating electronic systems are becoming increasingly important in military applications. Operational requirements in the range of 10 to 12 seconds must be accomplished with a combination of tube and circuit design. Definitions of tube and system operational time are numerous and interrelated so that selection of an appropriate test depends on the circuit application, ease of measurement, and test equipment capabilities. Circuit designs which minimize differences among tubes will also minimize drift during warm-up so that a stable operating point is reached more quickly. Properties of the vacuum tube classed as detrimental, such as interelectrode leakages, are more critical in fast operational tubes. Gains in operational time are achieved by: (1) reduction of the heated mass, (2) high cathode activation, and (3) reduction of conduction losses. General design considerations of the heater, cathode, and tube assembly are discussed. Six tube types encompassing subminiatures, miniature, hydrogen thyratron, and power triodes were developed and produced which function at 10 seconds in a fast operational system. Tube characteristics are given. (auth)

10688 SCR-18

Sandia Corp., Albuquerque, N. Mex.

CONTACT-RESISTANCE SYMPOSIUM, BENDIX AVIATION CORPORATION, KANSAS CITY DIVISION, SANDIA CORPORATION, JUNE 14, 1957, ALBUQUERQUE, NEW MEXICO. May 1958. 40p. Contract AT(29-1)-789. $6.30(ph OTS); $3.00(mf OTS).

The objectives of the conference were to accomplish an interchange of information and study the determination of contact resistance. The effect of contacts on AEC production problems is discussed. Other discussions are presented on: applications of contact devices, present testing criteria, materials and process variables, process controls, and future development plans. (T.R.H.)

10689 SCTM-129-58(51)

Sandia Corp., Albuquerque, N. Mex.

A CONTINUOUSLY VARIABLE CONSTANT-CURRENT SOURCE. A. R. Phillips. June 3, 1958. 12p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

A constant-current source utilizing the constant-current characteristics of the 6AG7 pentode vacuum tube was designed and is being used in studies of semiconducting materials. The constant-current source is unique in that it is variable in setting from −30 to +30 ma with meter ranges of −100 to +100 μa, −1 to +1 ma, −10 to +10 ma, and −50 to +50 ma. Standard commercial components were used in construction. Uses and limitations of the device are discussed. (auth)

10690 USNRDL-TR-235

Naval Radiological Defense Lab., San Francisco.

A RADIOMETRIC METHOD FOR DETERMINING SPECIFIC HEAT AT ELEVATED TEMPERATURES. C. P. Butler and E. C. Y. Inn. May 20, 1958. 30p.

The validity of radiometric method for the measurement of specific heat of metals as a function of temperature at elevated temperatures is investigated. The method consists in heating a small specimen of metal by radiation from a carbon arc and then allowing it to cool by radiation to the walls of an evacuated chamber. The specimens are coated with platinum black so that they have an emissivity of 1.0. From the area, mass, and cooling rate, the specific heat at any temperature below the maximum may be obtained. Six pure metals have been measured and the results compared to the handbook values. (auth)

10691 NP-tr-91

ON A NEW METHOD IN THE THEORY OF SUPERCONDUCTIVITY. N. N. Bogoljubov. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1957. 16p.

It is shown that the theory of interacting electrons and phonon fields may be extended to yield a consistent theory of the superconductive state which gives results which confirm those of Bardeen's. (D.E.B.)

10692 SCL-T-187

THE MEASUREMENT OF THE EFFICIENCY OF SHORT UNBALANCED METRE-WAVE AERIALS. (Die Messung des Antennenwirkungsgrades von Kurzen Unsymmetrischen Meterwellen-Antennen.) Max Lohr. Translated by M. E. Weinreich from NIZ-Nachrtech. Z. 10, 120-4(1957). 13p.

A measuring method involving determination of the relative loss of active power in a quadrupole is described. It enables one to determine easily and accurately the particular efficiency of unbalanced (asymmetric) aerials in the meter-wave range. (T.R.H.)

10693

STUDIES IN HIGH ENERGY PARTICLE PHYSICS MADE IN THE SYNCHRO-CYCLOTRON AT THE LABORATORY FOR NUCLEAR PROBLEMS OF THE UNITED NUCLEAR RESEARCH INSTITUTE. V. P. Dzhelepov and B. M. Pontekorvo. Atomnaya Energiya 3, 413-43(1957). (In Russian)

The achievements of Soviet physicists in the field of high-energy particles are described in detail. Topics discussed include construction of the synchrocyclotron and its characteristics, reconstruction of the accelerator and its present efficiency, experiments with 280-Mev deuterons and 560-Mev alpha particles, elastic scattering of nucleons by nucleons, interaction of mesons and nucleons, and methods of investigation and apparatus. (J.S.R.)

10694

THE HIGH TEMPERATURE STABILITY OF PERMANENT MAGNETS ON THE IRON–NICKEL–ALUMINUM SYSTEM. A. G. Clegg and M. McCaig (Permanent Magnet Association, Sheffield, Eng.) Brit. J. Appl. Phys. 9, 194-9(1958) May.

The open circuit magnetization of rectangular bars of various modern permanent magnet alloys has been measured at temperatures up to 550°C. A differential ballistic method has been used and, after magnetization at room temperature, both reversible and irreversible losses occur on heating. These losses vary with material and dimension ratio, and in an attempt to explain

these variations demagnetization curves at 500°C have been measured. To avoid the irreversible losses, stabilization at a higher temperature is better than ageing in an alternating field. (auth)

10695

PHOTOCONDUCTIVITY. D. A. Wright (General Electric Co., Ltd., Wembley, Middlesex, Eng.). Brit. J. Appl. Phys. 9, 205-14(1958) June.

The basic factors influencing photoconductivity are discussed, and the general pattern of behavior to be expected is indicated. The preparation and properties of cadmium sulfide are then dealt with in some detail. Other photoconducting compounds are described more briefly, and it is shown that their properties also fit into the general pattern. Following a discussion of the nature of the impurities and defects in the crystal lattice which influence the sensitivity, the applications of photoconductors are outlined briefly. (auth)

10696

ASYMMETRIC IMAGES DUE TO MISALIGNMENT IN THE ELECTRON MICROSCOPE. Koichi Kanaya, Akira Kato, and Iwao Yamaji (Electrotechnical Lab., 2-chome, Nagata-cho, Chiyoda-ky, Tokyo). Denki Shikensho Ihô 22, 281-98(1958) Apr.

An obvious effect of any misalignment of electron lens elements, as well as of any constructional inaccuracies, is to spoil the axial symmetry of images. Two very serious instances of misalignment, a lateral shift and a tilt of a lens, are considered. Theories of asymmetric images depending on the astigmatism caused by the misalignment together with the inclination of incident electron beam are consistently treated and mathematically developed from the image formation theory. In order to obtain the practical design data for high resolving electron microscopes, a number of asymmetric images due to the displacement between the objective and projective lenses are observed by applying the deflecting field excited by the magnetic coil to electron beam. Tolerances of misalignment obtained by experiments are compared with theoretical values. (auth)

10697

LIQUIDLIKE PROPERTIES OF FLUIDIZED SYSTEMS. Junji Furukawa and Tsutomu Ohmae (Kyoto Univ.). Ind. Eng. Chem. 50, 821-8(1958) May.

Although many studies of fluidization are available for use in design or operational procedures, the chemical engineering approach does not lead to a true understanding of a fluidized particle system. In this investigation, the nature and properties of a liquid system are used as a basis for deriving equations applicable to a fluidized system. Correlations based on experimental data were found for expansion, viscosity, surface tension, and miscibility. (auth)

10698

CHARACTERISTICS OF JUNCTIONS IN GERMANIUM. N. J. Harrick (Philips Labs., New York). J. Appl. Phys. 29, 7C4-70(1958) May.

Infrared radiation has been used to obtain a direct measure of the added carrier concentrations immediately adjacent to a junction when a current was passing through it. The current vs. carrier density characteristics thus determined can provide sensitive tests of junction theory. For junctions between two highly doped germanium regions and low injection levels, the experimental results agree with existing theory. For these junctions and high injection levels, or for junctions between regions where one or both sides may be lightly doped and for arbitrary levels of injection, it is necessary to extend the theory. This is done by extending the boundary conditions for higher levels of injection and using the current equations in the ambipolar form, where the field as well as the diffusion currents are considered. The resulting current vs. carrier density relationship involves the total current and takes into account, for both sides of the junction, the change in conductivity with injection level and the change in the drift length with the applied electric field. If, in addition, the change in lifetime with injection level is taken into consideration, good agreement obtains between experiment and theory. Current-voltage relationships are also derived which contain the above mentioned improvements. (auth)

10699

HEAT CAPACITIES OF CrF_3 AND $CrCl_3$ FROM 15 TO 300°K. Wilford N. Hansen and Maurice Griffel (Iowa State Coll., Ames). J. Chem. Phys. 28, 902-7(1958) May.

The heat capacities of CrF_3 and $CrCl_3$ were measured over the temperature range from 15 to 300°K. CrF_3 has two peaks; the upper peak has its maximum at 69.8°K and is associated with a known magnetic transition. The lower peak has its maximum at 45.6°K and has not been correlated with magnetic phenomena. The total magnetic entropy is divided almost equally between the two. $CrCl_3$ has a single peak at 16.8°K which is associated with a ferromagnetic transition. For CrF_3, $S^0_{298.15}$ = 22.44 eu; for $CrCl_3$, $S^0_{298.15}$ = 29.38 eu. Other thermodynamic functions are tabulated. (auth)

10700

EFFECTS OF ELASTIC DISTORTION OF ROTATING MIRRORS ON TIME RESOLUTION IN SMEAR CAMERAS. T. E. Holland and W. C. Davis (Los Alamos Scientific Lab., N. Mex.). J. Opt. Soc. Amer. 48, 365-71(1958) June.

The basic relations for the rotating mirror smear camera are reviewed and expressions are obtained for the maximum time resolution obtainable in systems uncorrected for the elastic distortion of the mirror surface. Instrumentation for the measurement of the surface distortion at high speed is described and data are reported for rotating rectangular parallelepipeds as a function of size and width-to-thickness ratio. The central sections of the mirrors deform cylindrically, the power varying nearly with the square of the peripheral speed. The distortion effects can be almost completely compensated by the introduction of negative astigmatism into the system. An auxiliary optical system is described which aids in the adjustment of the corrector lens to obtain optimum resolution. A corrected system in current use has a time resolution of 10^{-8} sec with relative aperture $f6$. (auth)

10701

THE CARBON FILMS FOR USE WITH ELECTROSTATIC ACCELERATORS. N. Sarma (Atomic Energy Establishment, Trombay, India). Nuclear Instr. 2, 361-2(1958) May.

Thin films of carbon were prepared in a vacuum chamber by passing a current of 100 amps through carbon electrodes and allowing the carbon to evaporate on microscope slides coated with NaCl. (W.D.M.)

10702

A SOURCE OF NEGATIVE HYDROGEN IONS. A. V. Almazov and Yu. M. Khirnyy. Pribory i Tekh. Ekspt. No. 5, 54-8(1957). (In Russian)

A negative hydrogen ion source in which mercury vapor is used is described. From measurements made on the beam at various energies it was concluded that the optimum "target thickness" is (1 to 2) × 10^{15} atoms/

cm^2. The recharging coefficient is given as a function of energy. The optimum proton energy for recharging is 10 to 12 kv. (J.S.R.)

10703
ON THE STABILITY OF A PLANE STATIONARY SHOCK WAVE. S. V. Iordanskiy. Priklad. Mat. i Mekh. 21, No. 4, 465-72(1957).

A plane piston is assumed to move with constant velocity in the direction of the negative x axis in a homogeneous medium. The perturbations of the hydrodynamic parameters behind the front of the rising shock wave are considered. The stability conditions and an asymptotic law for the attenuation of the perturbations are obtained. The influence of the reflection on the surface of the piston is also considered. (J.S.R.)

10704
THE INFLUENCE OF THE BOUNDARY LAYER ON THE GAS FLOW IN A TUBE BEHIND A MOVING SHOCK WAVE. Yu. A. Dem'yanov. Priklad. Mat. i Mekh. 21, No. 4, 473-7(1957).

By application of previous results on the formation of a boundary layer (Dem'yanov, Priklad. Mat. i Mekh. 21, 3(1957)), a theoretical explanation was given of the phenomenon, observed by Glass and Patterson, that the velocity of the contact face increases under simultaneous decay of the shock-wave velocity. (J.S.R.)

10705
ON THE THEORY OF THE POLARIZATION OF FLUORESCENCE OF SOLUTIONS. P. I. Kudriashov and B. Ia. Sveshnikov. Soviet Phys. (Doklady) 2, 387-90 (1957) July-Aug.

It is a basic assertion of modern theory that fluorescence polarization depends on the viscosity and temperature of the solution as well as on the volume of the molecule and the duration of its excited state. Quantitative relations between these quantities were derived for the case of non-exponential quenching by foreign substances. The relationship was tested by an experimental study of the fluorescence of fluorescein solutions quenched by potassium iodide. (J.S.R.)

10706
DE HAAS-VAN ALPHEN EFFECT IN A VARIABLE MAGNETIC FIELD. A. M. Kosevich (Chernovtsy State Univ.). Soviet Phys. JETP 6, 545-72(1958) Mar.

A theoretical study is made of the characteristic features of the oscillations of the magnetic moment of a metallic specimen at low temperatures in a pulsed magnetic field. (auth)

10707
PHASE TRANSITIONS IN SOME SOLID SOLUTIONS CONTAINING LEAD ZIRCONATE. N. N. Krainik (Inst. of Semi-Conductors, Leningrad). Zhur. Tekh. Fiz. 28, 525-35(1958) Mar. (In Russian)

Specimens of $PbZrO_3-PbNb_2O_6$, $PbZrO_3-PbTa_2O_6$, $PbZrO_3-SrZrO_3$, and $PbZrO_3-PbSnO_3$ were prepared and the temperature dependence of dielectric penetrability and relative elongation, and the dependence of polarization on the electrical field tension of the specimens were studied. An intermediate seignettoelectric phase appears in the solid solution systems $PbArO_3-PbNb_2O_6$ and $PbZrO_3-PbTa_2O_6$. In solid solutions $PbZrO_3-SrZrO_3$ and $PbZrO_3-PbSnO_3$ four and three phase transitions between nonpolar states were observed. The causes and the nature of various phases in solid solutions of lead zirconate base are discussed. (tr-auth)

10708
PHASE TRANSITION IN SOLID SOLUTIONS OF CALCIUM HAFNATE IN LEAD HAFNATE. N. N. Krainik (Inst. of Semi-Conductors, Leningrad). Zhur. Tekh. Fiz. 28, 536-8(1958) Mar. (In Russian)

The temperature rate of dielectric penetrability and the angular tangent of dielectric losses were studied with synthesized solid solutions of $(Pb, Ca)HfO_3$. In addition to the two-phase transitions between the two different seignettoelectric states and seignettoelectric and paraelectric states observed in pure $PbHfO_3$, transitions of the third and fourth phases were detected. An increase in the $CaHfO_3$ content in the solution affected a temperature increase for the third and fourth transitions and a temperature reduction for first and second phases. The nature of the third and fourth phases is related either to the appearance of new seignettoelectric phases or to the appearance of paraelectric phases distorted by the small dimension calcium ions with the perovskite structure. (tr-auth)

Aerosols

10709 AEC-tr-3252
DYNAMICS OF A SUSPENDED LAYER OF A LIQUID IN A GAS. I. P. Mukhlenov. Translated from Zhur. Priklad. Khim. 30, 1750-5(1957). 9p.

The kinetics and dynamics of a suspended layer of an active foam are treated and a general critera equation is derived which describes the hydrodynamics of the foam layer and which is basic for a treatment of experimental data in order to obtain the calculated formulas. (W.D.M.)

Astrophysics

10710
EFFICIENCY OF ACCELERATION OF RELATIVISTIC PARTICLES IN THE CRAB NEBULA. Satio Hayakawa and Yoshinosuke Terashima (Kyoto Univ., Japan). Progr. Theoret. Phys. (Kyoto) 18, 555-7(1957) Nov.

The energy density of cosmic rays comparable to that of star light suggests the surprisingly high efficiency of converting the thermal energy into kinetic energy of relativistic particles. Although the storage of cosmic rays in the galactic magnetic field lowers the over-all efficiency, there must be some objects in which the acceleration is very efficient, since most of the stars, like the sun, are known to be rather poor producers of cosmic rays. An attempt is made to show on a semi-quantitative basis that the high efficiency is really seen in the Crab nebula, the remnant of a supernova in 1054. The arguments are based on hypotheses, which seem to be plausible, that (a) the electromagnetic radiations are caused by the synchrotron radiation of relativistic electrons and (b) the so called rapid process of forming transuranic elements that took place in the explosion of the supernova in 1054. (A.C.)

Cosmic Radiation

Refer also to abstract 10326.

10711
INVESTIGATIONS OF EXTENSIVE COSMIC-RAY AIR SHOWERS. O. Dovzhenko, V. Zatsepin, E. Murzina, S. Nickol'skii, I. Rakobol'skaya, and E. Tukish (Lebedev Inst. of Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 118, 899-903(1958) Feb. 11. (In Russian)

Measurements were made to determine the energy characteristics of extensive cosmic showers at 3860 m

above sea level. About 4×10^4 wide showers induced by 2×10^{15} to 10^{16} ev primary particles were recorded. The air shower cores with the number of particles $>10^5$ have, as a rule, more complicated structures than the showers with the number of particles $<10^5$. Several nuclear-active particles of comparable energy were found in the showers of number $>10^5$ particles, and no single particle released by the energy common to the showers with $<10^5$ particles was observed in it. (R.V.J.)

10712

AUTOMATIC RECORDING OF COSMIC RAY OUTBURST. Ya. L. Blokh and L. N. Korablev. Pribory i Tekh. Ekspt. No. 5, 58-9(1957). (In Russian)

A method for automatically recording the beginning of an increase in the intensity of the hard component of cosmic radiation is described. Increases greater than or equal to 5% can be measured with an accuracy of less than 0.5 min. The device includes a fast recorder of the number of coincidences seen by a cubic telescope which is also used for the continuous recording of cosmic radiation during the IGY. This telescope consists of three rows of counters with a 10 cm lead screen between the second and the third row. The instrument consists of two independent systems (2 cubes). Coincidences between pulses from the first, second, and third rows are produced by the hard component. Apart from the triple coincidences, double coincidences between the first and the second and the second and the third rows are also recorded. These coincidences are produced by the general and the hard component in a wide solid angle and can be used to determine the soft component. The beginning of the solar outburst is determined from the double coincidences (first and second row) which record the general component. This increases the statistical accuracy and the accuracy of fixing of the beginning of an outburst since the number of 1-2 coincidences is larger by a factor of 2.4 than the number of 1-2-3 coincidences. In addition, the 1-2 coincidences record the general component which in itself is more sensitive to solar outbursts than the hard component. In summing up the number of double 1-2 coincidences the total number of pulses increases to 240,000 per hour which in half-a-minute gives the statistical accuracy of ± 2.2%. In order to increase the stability of the working threshold, the recorded radiation is compared with the frequency of the standard oscillator which is stable to 0.1 to 0.01%. The comparison is carried out by means of a discrete count of the radiation pulses and the pulses from the oscillator. (TCO)

10713

MEASUREMENT OF THE PRIMARY COSMIC-RAY FLUX AT 31° N LATITUDE. K. I. Alekseeva, S. I. Brikker, N. L. Grigorov, F. D. Savin, and N. A. Shcherbakov (M. V. Lomonosoy Moscow State Univ.). Soviet Phys. (Doklady) 2, 303-7(1957) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 338.

10714

THE INTERACTION BETWEEN LEAD NUCLEI AND COSMIC RAY PROTONS AT ABOUT 10^{10} ev. L. T. Baradzei, V. I. Rubtsov, Iu. A. Smorodin, M. V. Solov'ev, B. V. Tolchakev, and Z. I. Tulinova (M. V. Lomonosov Moscow State Univ. and P. N. Lebedev Physics Inst., Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 367-70(1957) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 1458.

10715

ON THE LATERAL DISTRIBUTION OF PARTICLES IN AN ELECTRON-PHOTON SHOWER. V. V. Guzhavin and I. P. Ivanenko (M. V. Lomonosov Moscow State Univ.). Soviet Phys. (Doklady) 2, 407-11(1957) July-Aug.

10716

ON THE INTERACTION OF HIGH-ENERGY PARTICLES WITH NUCLEI. A. P. Zhdanov, I. B. Berkovich, K. I. Ermakova, F. G. Lepekhin, N. V. Skirda, and Z. S. Khokhlova (V. G. Khlopin Radium Inst., Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 412-15 (1957) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 2379.

10717

INVESTIGATION OF NUCLEAR DISINTEGRATIONS PRODUCED BY THE CHARGED COMPONENT OF COSMIC RADIATION. T. L. Asatiani and G. V. Khrimian (Physics Inst., Academy of Sciences, Armenian SSR). Soviet Phys. JETP 6, 437-40(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 2998.

10718

SOLUTION OF THE KINETIC EQUATIONS FOR HIGH-ENERGY NUCLEAR CASCADE PROCESSES. N. M. Gerasimova (P. N. Lebedev Physics Inst., Academy of Sciences, USSR). Soviet Phys. JETP 6, 488-93(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 2999.

10719

ON THE GREEN'S FUNCTION OF THE KINETIC EQUATIONS OF A CASCADE. Kh. Ya. Khristov (Moscow State Univ.). Soviet Phys. JETP 6, 524-34(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3000.

10720

PARTICLE ANGULAR DISTRIBUTION FUNCTION AT THE CASCADE SHOWER MAXIMUM. I. P. Ivanenko (Moscow State Univ.). Soviet Phys. JETP 6, 637-9 (1958) Mar.

The distribution function of particles with respect to energy and angle was calculated at cascade shower maximum without assuming small deflection angles. The scattering was not considered to be multiple. Equations determining the energy and angular distribution function of electrons are derived. (J.S.R.)

Crystallography and Crystal Structure

Refer also to abstract 10756.

10721 AECU-3706

Case Inst. of Tech., Pittsburgh.

AN INVESTIGATION OF SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES. Quarterly Status Report No. 20 [for] March 2, 1958 to June 2, 1958. H.B. Probst, E. B. Evans, and W. M. Baldwin, Jr. June 4, 1958. 4p. Contract AT(11-1)-258. $1.80(ph OTS); $1.80(mf OTS).

Work on production of large scale single crystals of zirconium was continued. The strain anneal method of crystal growth was used experimentally on iodide zir-

conium, however, the grain size was too small (0.5 mm) for orientation studies. The continuous vacuum anneal method was used for sheet and bar samples, yielding a bar sample containing grains about 8 mm in diameter. (For preceding period see M-6466.) (J.R.D.)

10722 NP-6716
Eagle-Picher Research Labs. Mining and Smelting Div., Miami, Okla.
RESEARCH ON GROWING OF CADMIUM SULFIDE CRYSTALS FOR DOSIMETER PURPOSES. Quarterly Report No. 3 for Period October 17, 1957 to January 17, 1958. J. E. Powderly and K. E. Bean—W. E. Medcalf, ed. 65p. DA Project No. 3-99-00-100. Contract DA-36-039-SC-73270.

The theoretical and experimental aspects of the growing of single crystals of cadmium sulfide and the relationship of these aspects of crystal growth to such properties as conductivity; sensitivity to gamma rays, visible light, and other forms of energy; stability; and reproducibility are discussed. (A.C.)

10723 WADC-TR-57-627
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
PHOTO-CONDUCTIVE MATERIALS FOR USE IN HIGH INTENSITY NUCLEAR RADIATION MEASUREMENTS. Period Covered: June 1, 1956 to July 31, 1957. Robert J. Robinson and Leonid V. Azaroff. Nov. 6, 1957. 61p. Project 6002. Contract AF33(616)-3762.

The results of a one year program for the study of photoconductive materials for use in high intensity nuclear radiation measurements are described. The major accomplishment of this program is the correlation of gamma ray induced photoconductivity to the well known visible light induced photoconductivity. The phenomenological theory of photoconductivity is shown to apply to the gamma ray region as well as to the visible light region. The energy dependence observed in the response of CdS crystals is shown to be due to the energy dependence of the absorption process. The average ionization energy is shown to be in good agreement with independent measurements employing alpha and beta rays. Two methods for growing single crystals, a flow system and a static system, were employed in the preparation of single crystals of cadmium sulfide. These can be grown large enough for device purposes, and with the desired electrical properties by control of the impurities added. Polycrystalline detectors can be prepared in several ways; however, their response properties are not as good as those obtained with single crystals. (auth)

10724
POLYGONIZATION OF COPPER. F. W. Young, Jr. (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 29, 760-4(1958) May.

It has been demonstrated that dislocations can be revealed as etch pits in copper crystals doped with a small amount of Te. The progress of polygonization of such copper after bending was followed with etch pits and x-ray diffraction. It was found that climbing occurred at 500°C and that polygonization was complete after 2 hr at 1000°C. In similar experiments with three samples of nominally 99.999% copper, the one which was probably purest did not polygonize, while the other two did so. This indicates that if impurity is necessary for polygonization, only a very small amount is required. (auth)

10725
GROWING OF FERROELECTRIC $PbTiO_3$ CRYSTALS. Jinzo Kobayashi (Waseda Univ., Tokyo). J. Appl. Phys. 29, 866-7(1958) May.

A method of growing and preparing lead titanate crystals is presented. The optimum condition of the method and source features of the product are briefly described. (A.C.)

10726
EQUATION OF STATE OF ZINC, CADMIUM AND MAGNESIUM. S. Shivananda Tolpadi (Banaras Hindu Univ., India). Proc. Phys. Soc. (London) 71, 742-8(1958) May.

A method of deriving the equation of state of crystals belonging to the hexagonal system from the experimental data on specific heat, thermal expansion, and elastic constants was developed. The method is a modification of the one given by Dayal for cubic crystals. The pressures along the hexagonal axis and those perpendicular to it are divided into two parts, of which the first is the static part due to a non-vibrating lattice and the second due to the thermal vibrations. Two average Grüneisen constants were calculated from the experimental data and have been used in the calculation of the thermal pressures, along the two axes. The static pressure for a non-vibrating lattice is calculated as a function of the linear dimension from the condition that for the linear dimension measured at zero pressure, the sum of the thermal and static pressures must be zero. In this way the total pressure comes out to be the difference between the thermal pressure at a temperature T and length l and the one calculated for a temperature at which the crystal has the same length at P = 0. Detailed calculations have been made for zinc, cadmium, and magnesium. It is found that in all cases except in the case of cadmium perpendicular to the hexagonal axis, the calculated results are in good agreement with Bridgman's experimental measurements. It has been shown that the equation of state derived from the assumption made by Grüneisen about two Debye characteristic temperatures, one perpendicular and the other parallel to the hexagonal axis, does not agree with the experimental observations made by Bridgman. (auth)

Electrical Discharge

10727 UCRL-5225
California. Univ., Livermore. Radiation Lab.
BIBLIOGRAPHY OF REPORTS RELATING TO PROJECT SHERWOOD (CONTROLLED THERMONUCLEAR REACTIONS) WRITTEN AT UNIVERSITY OF CALIFORNIA RADIATION LABORATORY, LIVERMORE AND BERKELEY—1953 THROUGH 1957—UNCLASSIFIED SECTION. Frederick E. Frost, comp. May 1, 1958. 10p. Contract [W-7405-eng-48]. $1.80(ph OTS); $1.80(mf OTS).

This bibliography is a compilation of titles to unclassified reports, journal articles, and conference papers. The individual papers are divided into sections according to the year in which they appeared. (M.H.R.)

10728 UCRL-8255
California. Univ., Berkeley. Radiation Lab.
DISSOCIATION OF H_2^+ IONS BY ELECTRIC FIELDS. John R. Hiskes and Jack L. Uretsky. Apr. 24, 1958. 13p. Contract W-7405-eng-48. $0.50(OTS).

Some preliminaty calculations pertinent to the dissociation of H_2^+ ions by electric fields are presented. The calculations pertain to those ions which are in the various vibrational states belonging to the ground electronic state of the system. To dissociate these ions in a time on the order of one second, electric fields on the

order of 10^6 volts per centimeter are estimated for those ions populating the highest vibrational state. Fields on the order of 10^8 volts per centimeter appear to be required for those ions in which the ground vibrational state is populated. (auth)

10729

COMPLEX CONDUCTIVITY OF PLASMA OF AN ARC DISCHARGE, MAINTAINED BY DC. Jiri Kracik (Physics Faculty, CVUT, Prague). Československ. časopis fys. 6, No. 3, 264-76(1956). (Translated from Referat. Zhur. Fiz. No. 4, 1957, Abstract No. 9822.)

10730

ON THE THEORY OF SPECTRAL LINE BROADENING IN PLASMA. V. I. Kogan (Moscow Inst. of Engineering Physics). Doklady Akad. Nauk S.S.S.R. 118, 907-10 (1958) Feb. 11. (In Russian)

The theory of spectral line broadening in the Stark effect was analyzed considering the disturbance of the emitting atoms of a large group of moving charged particles by the electric field. The relation between the statistical and impact theories which up to the present time were considered (for the Stark effect) only in the approximation of consequent atomic collisions with separate disturbance particles is examined. In the theory proposed it is assumed that the electrons as well as the ions can be classically described, that the spatial distribution is accidental in a given mean density, and that the disturbance field is homogeneous and has an adiabatic action on the atom. (R.V.J.)

10731

RADIATION OF PLASMA IN MAGNETIC FIELD. B. A. Trubnikov. Doklady Akad. Nauk S.S.S.R. 118, 913-16 (1958) Feb. 13. (In Russian)

10732

EXCITATION SPECTRUM OF A SYSTEM OF MANY PARTICLES IN A MAGNETIC FIELD. M. V. Tarnavskaya and V. A. Yakovlev. Dopovidi Akad. Nauk Ukr. R.S.R. No. 5, 448-52(1957). (In Russian)

The results of an investigation of excitation spectra in systems of charged particles of one sign in a constant homogeneous magnetic field are given. These results can be applied to an electron plasma. The "dispersion equation" takes into account all the quantum effects for the case of particles interacting according to any central law. The most complete results are obtained for the particles with the Coulomb interaction law (for "plasma"). The method of density matrix is employed, and the presence of half-integer spin of the particles and correlation due to identity of the particles are taken into consideration. The dispersion equation obtained connects the oscillation frequency with the wave vector. The equation is solved, by means of expansion into a series by Bessel functions, for two cases of low temperatures and high temperatures, when the degeneration of the electron gas is not considered. It can be shown by this method that magnetic field strength does not affect the excitation spectrum of Bose-particle systems at T = 0. (TCO)

10733

ON THE STABILITY OF A PLASMA. Yu. A. Tserkovnikov. Dopovidi Akad. Nauk Ukr. R.S.R. No. 5, 461-5(1957). (In Russian)

The stability of a plasma was investigated with respect to initial fluctuational disturbances in the stationary distribution functions $f_i(\vec{v}\,\vec{x})$ of the electric field E and magnetic field H in the case of high frequencies. Linearized Boltzmann equations without collision terms were used for the variations of the distribution function δf_i (where index i denotes plasma components). It is assumed that the intensity of the magnetic field H is high and the free path of particles composing the plasma is by far longer than the Larmor radius. The function is sought for $f(\vec{v}\,\vec{x})$ by expansion by inversed powers of the magnetic field H. The method proposed is demonstrated by an example of a system with an intermediate curvature of the magnetic field. (TCO)

10734

THE EMISSION OF LIGHT FROM ELECTRIC DISCHARGES OF MICROSECOND DURATIONS IN GASES AT ATMOSPHERIC PRESSURE. D. P. C. Thackeray (Univ. of Cambridge, Eng.). J. Sci. Instr. 35, 206-12 (1958) June.

The performance of four types of spark discharge, widely used as light sources of high intensity and short duration is compared. Using the same capacitor and stored energy, electrical and light emission waveforms, and integrated spectra, were recorded for each type of discharge. Air sparks, both free and guided across the surface of an insulator, and argon sparks both within a jet of argon, and enclosed by a quartz capillary tube, were studied. The results are discussed in terms of the possible applications in fast photography and the photo-irradiation of materials. Particular attention is drawn to the novel properties of the discharge within an argon jet, as this affords a source of high positional stability and repeatability of performance, while retaining the high intensity and small size of other discharges. (auth)

10735

KINETICS OF THE ELECTRONS IN A DISCHARGE IN MAGNETIC FIELDS AT LOW PRESSURES. G. V. Smirnitskaya and E. M. Reykhrudel'. Radiotekh. i Elektron. 2, 1303-6(1957). (In Russian)

Equations for the motions of electrons in an electric discharge in a low-pressure tube having a ring anode and two disc cathodes situated at equal distances from the anode were derived. It was assumed that the electron motion was independent of the space charge. At magnetic fields greater than a certain critical value H_{kp}, the electron is subject to both a rotational and a harmonic motion. For magnetic fields equal to or lower than H_{kp}, the electron trajectories are in the form of an exponential spiral. It was concluded that a glow discharge cannot exist in the tube at magnetic fields lower than H_{kp}. Experimental confirmation of this last statement was obtained by showing that at an anode potential of 3000 v and a pressure of 10^{-6} mm Hg no discharge could be obtained at magnetic fields less than 200 gauss. (J.S.R.)

10736

ON THE MODES OF PLASMA OSCILLATIONS IN A MAGNETIC FIELD. S. I. Braginskii. Soviet Phys. (Doklady) 2, 345-9(1957) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 1465.

10737

THE BEHAVIOR OF A COMPLETELY IONIZED PLASMA IN A STRONG MAGNETIC FIELD. S. I. Braginskii (Academy of Sciences, USSR). Soviet Phys. JETP 6, 494-501(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3010.

10738

ON MAGNETOHYDRODYNAMICAL EQUILIBRIUM CONFIGURATIONS. V. D. Shafranov (Academy of Sciences, USSR). Soviet Phys. JETP 6, 545-54(1958) Mar.

The equilibrium conditions for bounded systems of a

conducting gas in a magnetic field are investigated. The equilibrium conditions for a thin ring with a helical current in an external magnetic field were obtained by taking into account gravitational forces and assuming the ring to be surrounded by gas. A theorem was formulated concerning the correspondence between magnetohydrodynamical equilibrium systems and hydrodynamical vortices. By use of this theorem the problem of the equilibrium conditions for magnetohydrodynamical configurations is reduced to the theory of stationary flow of an incompressible fluid. For the case of axial symmetry, general equilibrium conditions for distributed currents are considered. (auth)

10739

SCATTERING OF ELECTROMAGNETIC WAVES IN A PLASMA. A. I. Akheizer, I. G. Prokhoda, and A. G. Sitenko (Khar'kov State Univ.). Soviet Phys. JETP 6, 576-82(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3011.

10740

MAGNETO-VORTEX RINGS. V. D. Shafranov (Academy of Sciences, USSR). Soviet Phys. JETP 6, 642-4 (1958) Mar.

It is shown that any equilibrium configuration or any stationary flow of an incompressible fluid corresponds to the stationary flow of an incompressible, perfectly conducting fluid in a magnetic field H, in the direction of the current of the fluid v. As examples, the velocity and pressure distributions are derived for the case of a ring current in a magnetic field and a circular vortex. (J.S.R.)

Electrons

Refer to abstracts 11074 and 11099.

Gases

10741

ON THE VIRIAL COEFFICIENTS FOR A LENNARD-JONES GAS. L. H. Nosanow and J. E. Mayer (Univ. of Chicago). J. Chem. Phys. 28, 874-7(1958) May.

Simpler methods for computing the second and third virial coefficients for a Lennard-Jones gas are given. The second virial coefficient is found to obey a second-order linear homogeneous differential equation in the temperature. The use of these methods is discussed. (auth)

10742

THERMAL CONDUCTIVITY OF MULTICOMPONENT GAS MIXTURES. Edward A. Mason (Univ. of Maryland. College Park). J. Chem. Phys. 28, 1000-1(1958) May.

Formulas for the calculation of thermal conductivity of multicomponent gas mixtures have previously been derived by Curtiss and Hirschfelder as an extension of the classical Chapman-Cowling approach for binary mixtures. These formulas involve extremely laborious numerical computation involving large determinants with complicated elements. It is shown that a much simpler formula can be derived with the same degree of rigor as the complicated Curtiss-Hirshfelder. It is shown that this simpler formula can be reduced by suitable approximations to the same form as a successful empirical formula. (J.E.D.)

10743

RELATIVE BETA-RAY ENERGY LOSS PER ION PAIR PRODUCED IN WATER VAPOR AND IN AIR. C. Wingate, W. Gross, and G. Failla (Columbia Univ., New York). Radiation Research 8, 411-16(1958) May.

The average energy lost by Ni^{63} beta particles per ion pair produced in water vapor was calculated and comparison made with values for ion pair production in air. Data are included on measurements made in nitrogen and ethylene. A schematic sketch is included of the ionization chamber and associated system used in the measurements. (C.H.)

Instruments

10744 AED-BRD-1

Marburg, Germany. Universität. Physikalisches Institut.

MESSGERÄTE — PROGRAMM. (Measuring Devices — Program). Nos. G 1-16. 1956/57. 7p.

An outline is given of the program for the design and construction of various electrical measuring devices and their auxiliaries. (J.S.R.)

10745 AED-BRD-3

Marburg, Germany. Universität. Physikalisches Institut.

IMPULSVERSTÄRKER. (Impulse Amplifier). No. G 2. 1956. 21p., 4 illus.

Specifications and engineering drawings of an impulse amplifier designed to amplify electrical impulses are presented. (J.S.R.)

10746 AED-BRD-5

Marburg, Germany. Universität. Physikalisches Institut.

GLEICHSPANNUNGS-STABILISIERUNGSGERÄT (+300 V) STAB. 1. (Direct Current Voltage Stabilization Instrument (+300 V) Stab. 1. No. G 6. 1956. 8p., 4 illus.

Specifications and engineering drawings of a direct current voltage stabilizer designed to give the anode current necessary for the operation of electronic measuring devices are presented. (J.S.R.)

10747 AED-BRD-6

Marburg, Germany. Universität. Physikalisches Institut.

GLEICHSPANNUNGS-STABILISIERUNGSGERÄT (−200 V) STAB. 2. (Direct Current Voltage Stabilization Instrument (−200 V) Stab. 2). No. G 7. 1956. 3p., 1 illus.

Specifications and engineering drawings of a direct current voltage stabilizer designed to give negative voltage against ground are presented. (J.S.R.)

10748 AED-BRD-7

Marburg, Germany. Universität. Physikalisches Institut.

VERSTÄRKER-GESTELL. (Amplifier Mount). No. G 10. 1956. 3p., 1 illus.

Engineering drawings for an amplifier mount are presented. (J.S.R.)

10749 AED-BRD-8

Marburg, Germany. Universität. Physikalisches Institut.

HOCHSPANNUNGSGLEICHRICHTER — HG 1. (High Voltage Rectifier — HG 1). No. G 14. 1956. 7p., 1 illus.

Specifications and engineering drawings of a high voltage rectifier designed for use with several scintillation detectors are presented. (J.S.R.)

10750 AED-BRD-35

Marburg, Germany. Universität. Physikalisches Institut.

HOCHSPANNUNGSGLEICHRICHTER MIT STABIL-

ISIERUNGSGERÄT (HOCHSPANNUNGSGERÄT I)—HGS. (High Voltage Rectifier with Stabilizer (High Voltage Apparatus I)—HGS). No. G 8. 1957. 22p., 5 illus.

Specifications and engineering drawings of a high voltage rectifier with stabilizer designed to supply a scintillation detector with high tension and operating voltage are presented. (J.S.R.)

10751 AED-BRD-36

Marburg, Germany. Universität. Physikalisches Institut.

FENSTERVERSTÄRKER (FENST V). (Window Amplifier (Venst V).) No. G 12. 1958. 14p., 4 illus.

Specifications and engineering drawings of a window amplifier are presented. (J.S.R.)

10752 AED-BRD-37

Marburg, Germany. Universitätt. Physikalisches Institut.

HOCHSPANNUNGS-STABILISIERUNGSGERÄT. (High Voltage Stabilizer). No. G 15. 1957. 12p., 4 illus.

Specifications and engineering drawings for a high voltage stabilizer designed to stabilize the high voltage produced by the high voltage rectifier are presented. (J.S.R.)

10753 CF-58-5-2

Oak Ridge National Lab., Tenn.

LOW-TEMPERATURE CAPILLARY-TUBE VISCOMETER FOR AQUEOUS THORIUM OXIDE SLURRIES. L. L. Bennett. May 30, 1958. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

As part of the over-all program of investigation of the rheological properties of aqueous thorium oxide slurries, a capillary-tube viscometer was designed for routine determination of shear diagrams of slurries over a temperature range of 30 to 85°C. A particular feature of this viscometer is the vertical orientation of the capillary tube which minimizes the effect on the results obtained with dilute, rapidly settling slurries. (auth)

10754 K-1257

Oak Ridge Gaseous Diffusion Plant, Tenn.

A SUPPRESSED VOLTAGE INSTRUMENT FOR MEASURING INSTABILITY OF DIRECT CURRENT SUPPLIES. J. Farquharson. June 13, 1958. 9p. Contract W-7405-eng-26. $0.50(OTS).

An instrument was developed to record voltage instability as low as 25 ppm in a source of direct current. A double potentiometer method is used, in which a sample of the voltage under test is compared with a stable battery voltage and the difference fed to an electronic strip chart recorder. The instrument is simple to operate and relatively inexpensive. (auth)

10755 KAPL-M-GLC-2

Knolls Atomic Power Lab., Schenectady, N. Y.

THE UNIVERSAL PRECISION DILATOMETER. G. L. Cutler. Apr. 23, 1958. 19p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

An automatic, self-recording apparatus for reasonably accurate determination of coefficients of thermal expansion up to 1050°C (1922°F) of any workable solid material in an inert atmosphere, or in a vacuum to 10^{-6}, has been developed and is in use at the Knolls Atomic Power Laboratory. (auth)

10756 NP-6731

Pennsylbania State Univ., University Park.

DEVELOPMENT AND APPLICATION OF INSTRUMENTATION FOR X-RAY AND NEUTRON ANALYSIS. Final Report. Ray Pepinsky. May 20, 1958. 25p. DA Project No. 5B99-01-004. Contract DA-36-061-ORD-565.

Instruments for the purposes of rapid acquisition of diffraction data, information about morphology, measurement of physical properties of crystals, etc., have been developed and constructed. The photoelectric optical goniometer for automatic recording of stereographic projections of crystal morphology was completed and is in operation. Three models of the automatic single-crystal x-ray and neutron diffraction goniometer of the equi-inclination type were constructed. A new low-temperature stage for the General Electric XRD-3 spectrogoniometer has been constructed. (W.D.M.)

10757 SCDC-653

[Sandia Corp., Albuquerque, N. Mex.]

AN ELECTRONIC PULSER FOR USE IN THE STUDY OF TERRAIN RETURN. James Arlin Cooper. Mar. 4, 1957. 12p. Contract [AT(29-1)-789]. $3.30(ph OTS); $2.40(mf OTS).

An electronic pulser for adding a negative pulse to the return pattern of a radar scope used in the study of terrain is described. It is used to make a trace on the scope to facilitate film reading of the returns. (W.D.M.)

10758 SCTM-346-57(14)

Sandia Corp., Albuquerque, N. Mex.

A TRANSISTORIZED LINEAR RAMP GENERATOR WITH BIAS AND PEDESTAL CONTROLS AND ITS APPLICATION IN DIGITAL VOLTMETERS. Robert E. Daniels and Ross J. Sinkey. Feb. 3, 1958. 22p. Contract AT(29-1)-789. $4.80(ph OTS); $2.70(mf OTS).

A transistorized ramp generator and its application in two digital voltmeter circuits are described. The ramp generator is physically small and can be operated at high speeds. The generator utilizes a silicon transistor in the common base configuration, in conjunction with a voltage-regulating circuit as a current source. The ramp is generated by the constant current charging a stable, low-leakage capacitor. The duration of the ramp is controlled by a multivibrator which, in turn, is controlled by the associated measuring equipment. (W.D.M.)

10759 SCTM-347-57(14)

Sandia Corp., Albuquerque, N. Mex.

OPTICAL RANGING TRANSDUCER. R. E. Daniels and R. J. Sinkey. Feb. 4, 1958. 18p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

The image-positioning method of ranging, a technique in which the position of the image in the optical system is an indication of the range of the object, requires relatively simple techniques in both the optical and electronic systems and provides good protection from interfering signals. This memorandum describes the preliminary work completed on the optical system for a proposed image-positioning type of optical ranging system. (W.D.M.)

10760 AEC-tr-3233

A NEW TYPE OF A GAS THERMOMETER AND THE DETERMINATION OF THE BOILING POINT OF HYDROGEN. A. A. Borovik-Romanov and P. G. Strelkov. Translated by Lydia Venters from Doklady Akad. Nauk S.S.S.R. 83, 59-61(1952). 6p.

The thermometer design presented employs a membrane between two gas chambers and is sensitive to pressures of 0.01 mm of Hg. Boiling point temperatures for hydrogen determined through the use of this thermometer were: for 25% para hydrogen, 20.380°K; for 99.97% para hydrogen, 20.264°K. (D.E.B.)

10761
APPLICATION OF RADIOACTIVE ISOTOPES TO INSTRUMENTATION. M. B. Neyman. Avtomat. Tekh. Protses. v Mashinostr., Moscow, Akad. Nauk S.S.S.R. 55-73(1955). (Translated from Referat. Zhur. Elektrotekh. No. 3, 1957, p. 168)

A survey of uses of isotopes for the control of physical processes, and for measuring the properties of gases, liquids, and solids is presented. The application of radioactive isotopes in measuring and regulating temperature, accurate weighing, and chemical analysis is discussed. Radioactive isotopes can also be used in the preparation of stable standards of light and sources of high and low voltages. It is pointed out that the use of radioactive isotopes opens up new possibilities in instrumentation.

10762
A MICROWAVE SMALL POWER STANDARD. Takeshi Tamaru, Kenjiro Sakurai, and Taisuke Maruyama. Denki Shikensho Ihô 22, 251-64(1958) Apr. (In Japanese)

A microwave microcalorimeter for 7000 Mc/s band is described. The calorimeter is identifiable with the d-c calibrated, twin-type aneroid microcalorimeter, and its calorimetric body is a thin walled barretter mount. By using this barretter mount, the effective efficiency of which is determined by electric and thermal measurements, the effective efficiencies of other bolometer mounts are accurately determined by means of a magic T as a power divider and an impedance comparator. Analysis of the magic T is also included. (tr-auth)

10763
A NEW AMPLIFIER FOR PULSE SPECTROMETRY. G. G. Kelley (Oak Ridge National Lab., Tenn.). IRE National Convention Record Part 9, 63-8(1957).

A new amplifier was developed for scintillation spectrometry; it is overload characteristics suitable for use with very large detectors. Its recovery time from a 4000-times overload signal in about 8 μsec. There is no positive base line excursion after the main pulse. It uses the double delay line differentiation principle, has a gain of 7,000 in the main amplifier and an extra factor of 1, 3, or 10 in the preamplifier. The gain control range is by factors of 2 over a total range of 64. Rise time is about 0.20 μsec. The output stage is capable of driving a 1000-ohm load to greater than 100 volts in both directions. (auth)

10764
ON THE MEASUREMENT OF TRANSIT TIME DISPERSION IN MULTIPLIER PHOTOTUBES. M. H. Greenblatt (RCA Labs., Princeton, N. J.). IRE Trans. Nuclear Sci. NS-5, No. 1, 13-16(1958) June.

In the use of a multiplier phototube to measure short time intervals, the accuracy of the measurement is limited by the statistical deviations in the output pulse from the phototube. These deviations arise from variations in the electron transit time in the phototube. This paper reports a technique by which the transit time dispersion in the tube structure can be measured. A beam of electrons is deflected through an aperture onto the first dynode of the photomultiplier by an rf sweep voltage. The output pulse resulting is examined using the sweep voltage as a time base. Values of the order of 1 mμsec were obtained using three commercial type photomultiplier tubes. (auth)

10765
FRINGE SHARPENING IN DIVIDED BEAM INTERFEROMETERS. William Primak (Argonne National Lab., Lemont, Ill.). J. Opt. Soc. Amer. 48, 375-9(1958) June.

The development of sharpened fringes in long path length interferometers by intensity and by multiple reflection is described. The cause of the extreme localization of some of the multiple-reflection fringe patterns is discussed. (auth)

10766
A CATHODE-RAY TUBE ANALOGUE-TO-SERIAL DIGITAL CONVERTER. J. Willis and M. G. Hartley (Univ. of Manchester, Eng.). J. Sci. Instr. 35, 197-202 (1958).

Small fluctuations of the screen equilibrium potential of a cathode-ray tube cause proportionate small fluctuations in the steady secondary emission current arriving at a collector anode. The application of this fluctuation of secondary emission to an analogue-to-serial digital converter is discussed. An investigation of the parameters affecting changes of secondary emission using an electrode on the face of the tube, maintained at an alternating potential, to vary the screen potential is described. The secondary emission is observed as a signal, developed across a resistor between collector and earth, at screen electrode supply frequency, amplitude-modulated by the changes in secondary emission which occur when the screen is scanned by an electron beam. The effects of electrode potential, electrode width, steady state collected current, beam focus, bias applied to the collector and accelerating voltage are examined. The results are compared with those predicted from electrolytic tank studies. The variation of output over the screen surface under different operating conditions is discussed. Experiments to determine minimum electrode width and spacing, consistent with the production of a discrete pulse output from each electrode of a pattern, are described. (auth)

10767
A VACUUM EVAPORATOR FOR RADIOACTIVE AND TOXIC METALS. M. C. Inman and D. Quigley (National Physical Lab., Teddington, Middlesex, Eng.). J. Sci. Instr. 35, 226-7(1958) June.

Brief descriptions of a vacuum evaporator, which overcomes the difficulty in decontamination after use with radioactive and toxic metals, and methods for its use are given. (auth)

10768
A RECORDING SODIUM-LINE REVERSAL PYROMETER. W. M. Brobeck, R. E. Clemensen, and W. E. Voreck (Univ. of California, Livermore). Jet Propulsion 249-52(1958) Apr.

An instrument for the measurement of flame temperatures from 1500 to 2700°C by the sodium-line reversal method is described in which the eye and hand of a trained operator are replaced by a closed-loop electromechanical system. The advantages are in continuous recording of varying flame temperatures, increased accuracy, and measurement on flames that would be dangerous to an observer. (auth)

10769
AN APPARATUS FOR THE MECHANICAL DETERMINATION OF THE INTERPLANAR SPACING OF A LATTICE. F. Kgol'. Kristallografiya 2, 604-8(1957). (In Russian)

The device described enables distances measured on an x-ray diffraction photograph to be transformed directly to d (interplanar spacing) values. For cylindrical powder photographs, the films are mounted on cylindrical formers of twice the original cassette radii. A point of light is fixed on the film axis and a cursor lever is set against the particular line to be measured. The rotation of the lever from the central position is coupled to another arm which rotates through an angle propor-

tional to the Bragg angle and which forms part of a triangle analogous to the Bragg equation: $\sin\theta = (\lambda/2)/d$. Marks appropriate to the various common radiations are engraved on the panel of the instrument. Flat back-reflection films can also be measured. The interplanar spacing is read off with an accuracy of $\pm 10^{-4}$ A. Certain corrections, such as that for line displacement due to specimen opacity can be applied by drawing special datum lines on the panel. (TCO)

10770

APPARATUS FOR MEASURING EXTREMELY SMALL DISPLACEMENTS OF OSCILLATING CRYSTALS. A. A. Fotchenkov. Kristallografiya 2, 653-7(1957). (In Russian)

The crystal plate specimen which is to be investigated is mounted behind the stationary mirror of a Michelson interferometer and is excited at an audio-frequency in a thickness mode by an alternating voltage applied across evaporated silver electrodes. The fringe system is projected onto a slit and one line is allowed to fall on a photomultiplier cathode. The photomultiplier current is amplified, and the component at the frequency of the exciting oscillator is measured. The displacement of the fringe system is proportional to the change in thickness of the crystal specimen. The minimum displacement measurable is about 0.05 A. The illumination employed is a cinema projection lamp of 300 w, and the wavelength band between 5,100 and 5,290 A is passed into the interferometer by an interference filter. When conducting an experiment the interferometer is set to zero path difference, and the maximum and minimum values of I (the intensity of illumination falling on the cell) when the compensating plate is slightly moved are read. As a test, an X-cut plate of quartz, 2 mm thick and 18 mm in diameter, was used. The modulus d_{11} was measured at 3,000 c/s using a voltage of 100 which produced a displacement of 3.1 A. Acoustic and electrical interference limited the sensitivity to 0.5 A but at night 0.05 A could be attained. The method is recommended for measuring piezoelectric and electrostrictive effects, their temperature and frequency dependences, and studying polarization and phase transition phenomena in ferroelectrics. (TCO)

10771

MAGNETIC-MEMORY SCALING-SYSTEM WITH MAGNETIC COUNT INDICATION. E. Franklin and J. B. James (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Instr. 2, 348-60(1958) May.

Circuits are described which have many advantages over those at present being used in scaling equipment. Principally they make possible the design of scaling equipment which is small, light, cool running, of low power consumption, and very reliable. (auth)

10772

D. C. AMPLIFIERS FOR REACTOR INSTRUMENTATION. M. W. Jervis (AEI-John Thompson Nuclear Energy Co., Ltd.). Nuclear Power 3, 275-9(1958) June.

Large indicators, recorders, and relays in alarm circuits require relatively large operating forces and it is necessary to interpose some form of d.c. power amplifier between the detector and the display equipment or alarm and safety system. The various types available are described. (W.D.M.)

10773

AUTOMATIC TEMPERATURE REGULATOR. Yu. V. Krokhin. Obmen Opytom. Moskov. Radiotekh. Prom. S.S.S.R. No. 1, 4-8(1955). (Translated from Referat. Zhur. Elektrotekh. No. 3, 1957, p. 190)

A dilatometric temperature regulator for controlling temperature from −40 to 300° is proposed. It consists of a duraluminum tube, steel rod, and contact lever.

10774

PHOTO-ELECTRON AND ELECTRON MULTIPLIERS. N. S. Khlebnikov and A. Ye. Melamid. Pribory i Tekh. Eksp. No. 6, 6-18(1957).

A review is given of the properties and working conditions of multipliers produced in the USSR and used for measuring weak light sources and short light pulses. The tabulation of data covers the characteristics of multipliers used in scintillation counters, multipliers used for weak light sources, and multipliers used for multiplication of secondary electrons. (J.S.R.)

10775

A PHOTOELECTRIC FLUORIMETER. A. L. Osherovich. Pribory i Tekh. Eksp. No. 6, 104-6(1957). (In Russian)

A photoelectric fluorimeter is described which can be used to study weak fluorescence from both solids and liquids. The threshold of sensitivity is 10^{-12} lumen, and the time constant is 1.5 sec. The circuit used is shown. A recording potentiometer is used at the output, and the zero drift does not exceed 0.2 to 0.3 μa/hour. The instrument is cheap, stable, and linear. An accuracy of 3 to 10% can be achieved. (TCO)

10776

HIGHLY SENSITIVE WATTMETER FOR MEASURING LOSSES IN MAGNETIC SHEET MATERIALS. G. K. Yagola and N. M. Rudnyy. Trudy Vsesoyus. Nauch-Issledovatel. Inst. Metrol. No. 29, (89), 139-49(1956). (Translated from Referat. Zhur. Elektrotekh. No. 3, 1957, p. 157)

The construction of an electrodynamic low power factor wattmeter with a voltage measuring range of 30 to 75 to 150 v and a current measuring range of 2.5 to 5 amp is described. The 30-v range is not an auxiliary range, as in other wattmeters, but is used in normal operation. The rated power factor is 0.1. The accuracy limit is 0.5. The wattmeter is provided with a luminous indicator. The shielding employed is effective in keeping the error caused by external magnetic fields with an intensity of up to 0.5 oersteds below 0.05% of the upper limit of measurement. Research has shown that, under normal conditions, electromagnetic interaction of the movable part of the instrument and the field of the stationary coils (due to the presence of traces of ferromagnetic substances in the components of the movable part) causes a deflection not exceeding 0.1% of the scale length. For calibrating the wattmeter or for d-c measurements, the current must be one-tenth of the rated current, since the wattmeter is designed for $\cos\varphi = 0.1$. In this case, the error due to residual magnetization of the shield by the field of the stationary coils does not exceed 0.05%. The error due to inductance of the movable coil is kept below 0.5% by a compensating circuit. The error due to mutual inductance of the coils is not greater than 0.13%. The wattmeter is suitable for measuring losses in samples of sheet steel used in the electrical industry.

10777

PROVOLOCHNYE PREOBRAZOVATELI I IKH TEKHNICHESKOYE PRIMENENIYE. (Electric Resistance Wire Strain Gages and Their Practical Application). Afroin M. Turichin and Petr V. Novitskiy. Moscow-Leningrad, Gosudarstvennoye Energeticheskoye Izdatel'stvo, 1957. 171p. (In Russian)

A systematic presentation is given of the theoretical basis and the practical use of electric resistance strain

gages, together with design and experimental data. The book is intended for engineers and scientific workers who use instruments with strain gages for measuring deformations, stresses, and other mechanical quantities. (J.S.R.)

Isotopes

10778

ERRORS IN THE MASS-SPECTROGRAPHIC METHOD OF MEASURING THE MASS OF ISOTOPES. T. I. Gutkin. Pribory i Tekh. Ekspt. No. 5, 46-51(1957). (In Russian)

The effects of the space charge of the beam on the focusing conditions and the systematic errors in the mass of the isotopes caused by space charge were studied. A double focusing ion optical system was considered. The displacement of a line for such a system because of the beam space charge effect was obtained by solving the equation of motion of the ions in the field of the electrostatic and magnetic lenses. An explicit expression was obtained for this shift in terms of the magnitudes of the fields and the various geometrical parameters involved. It was shown that the space charge effect leads not only to a displacement of the cardinal points of the ion optical system, but also to a change in the dispersion properties of its various sections and thus causes systematic errors. It was shown that the magnitude of the systematic error is well outside the quoted accuracy of measurements and is consistent with the differences in the experimental values quoted by different authors. The space charge effect was investigated experimentally by photographing the spectra of doublets produced by ions with different initial velocities, using the CH_4–O doublet. Changes in the field intensity because of space charge were produced by changing the beam current, the mass of the ions in the beam which do not enter into the composition of the photographic doublets, and the vacuum in the chamber of the mass-spectrograph. (J.S.R.)

10779

VARIATIONS IN THE ISOTOPIC COMPOSITION OF MERCURY IN A DC ELECTRIC FIELD. I. V. Bogoiavlenskii, V. N. Grigor'ev, N. S. Rudenko, and D. G. Dolgopolov (Physico-Tech. Inst., Academy of Sciences, Ukrainian, SSR). Soviet Phys. JETP 6, 450-4 (1958) Mar.

Direct current was passed through liquid mercury and the time variation of the isotopic composition of the mercury was studied. The experiments were carried out at two temperatures. The variation of isotope concentration along the electric field was investigated, and the relation between the isotopic composition at the cathode and the applied voltage. The experimental data are compared with some phenomenological calculations and possible causes for the effect are discussed. (auth)

Isotope Separation

10780

ELECTROMAGNETIC ISOTOPE SEPARATING DEVICE FOR HEAVY ELEMENTS OF HIGH RESOLVING POWER. L. A. Artsimovich, G. Ya. Shchepkin, et al. Atomnaya Energiya 3, 483-91(1957).

An apparatus which is able to separate isotopes with a relative mass difference of 1/240 is described. An axial-symmetrical field, the dispersion of which is proportional to the square of the focusing angle, was used as a magnetic field. The focusing angle is 225°. The measured dispersion of the apparatus is 20 mm at a relative mass difference of the masses to be separated of 1%. The magnetic field is stabilized at 0.005% with the aid of a valve scheme. The acceleration velocity for the ion source (up to 40 kv) is stabilized by a double cascade scheme up to 0.01%. The current in the discharge source of ions is also stabilized. The vacuum chamber is constructed from stainless steel in a C shape. A working vacuum of 4 to 6×10^{-6} mm Hg is maintained. A normal gas discharge ion source in which the material to be separated can be heated to 1000°C is used. Results obtained for the concentration of Pb^{208}, Pb^{207}, U^{238}, U^{236}, Pu^{239}, Pu^{240}, and Pu^{241} are tabulated. (J.S.R.)

10781

EXPERIMENTAL INVESTIGATION OF EFFICIENCY VARIATIONS VERSUS PRESSURE IN THE ISOTOPES SEPARATION BY GASEOUS DIFFUSION METHOD. G. Perona (CISE, Milan). Energia nucleare (Milan) 5, 327-31(1958) May.

Research work has been conducted at the CISE laboratories to determine the effects of pressure variations on separation efficiency in gaseous diffusion units. An experimental confirmation is given of the Present and De Bethume law and the applicability of this theory to the separation of the uranium isotopes by gaseous diffusion. (auth)

10782

THE PERFORMANCE OF THERMAL DIFFUSION COLUMNS. W. W. Watson (Yale Univ., New Haven, Conn.). Chapter 34 of Proc. Symposium on Isotope Separation, Amsterdam, 446-61(1957).

Certain details of the construction and operation of multistage thermal diffusion isotope separation apparatus, both all-metal and glass-wall, for best performance are discussed. Comparison is made with the theory for the variation of separation factor with pressure and hot-to-cold wall temperature ratio for an accurately constructed and mounted hot-wire metal-wall column. The effect of spacers at frequent intervals on the hot wire is displayed, the conclusion being that they are most desirable for glass columns. Under turbulent conditions in the gas, isotope separation takes place to a greater extent than indicated by the theory. Capillary connection between columns, with gas-swinging back and forth, is preferable to convective coupling in multistage apparatus. "Trennschaukel" measurements are given for the variation of α, the thermal diffusion factor, with temperature for the noble gases. At 290°K, the usual temperature of cooling water, $R_T = \alpha'/\alpha$ (r.e.s.) = 0.485, 0.290, 0.170, and 0.110 for Ne, Ar, Kr, and Xe, respectively. Finally, batchwise recycling procedure to increase the isotope concentrations is discussed, with the krypton isotopes as an example. (auth)

10783

ISOTOPE SEPARATION ON THE PASSAGE OF AN ATOMIC BEAM THROUGH A REGION OF IONIZATION. K. D. Sinelnikov, B. G. Safronov, G. G. Aseev, and Yu. S. Azovsky (Physico-Tech. Inst., Academy of Sciences, SSSR). Soviet Phys. (Doklady) 2, 313-16(1957) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 389.

Mass Spectrography

10784 HW-55892

[General Electric Co. Hanford Atomic Products Operation, Richland, Wash.]

SURFACE IONIZATION MASS SPECTROMETER. IN-

STRUCTION MANUAL. K. Koyama. Oct. 31, 1957. 62p., 1 illus. $12.30(ph OTS); $4.50(mf OTS).

The operation, maintenance, theory, and installation of a surface ionization mass spectrometer are given. (W.L.H.)

10785 IGR-TN/CA-851

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.

ARGON ISOTOPE ANALYSIS WITH AN M.S.3 MASS SPECTROMETER USING THE DOUBLE-COLLECTION TECHNIQUE. P. G. Bentley and A. N. Hamer. 1958. 6p.

A Metropolitan-Vickers M.S.3 mass spectrometer was modified and used for measuring separation factors of pairs of Ar samples by the double-collection technique. The accuracy was 0.05% at the 95% confidence level. (T.R.H.)

10786

THE SEPARATION OF Ge AND Mg ISOTOPES IN A SMALL ELECTROMAGNETIC SEPARATOR. V. M. Gusev, D. V. Chkuaseli, and M. I. Guseva. Atomnaya Energiya 3, 215-21(1957).

The ion source and target of a small electromagnetic separator built according to Dempster's mass spectrograph are described. The ion source works satisfactorily up to temperatures of 1500°C. The target is constructed so that it collects all the isotopes of the element to be separated at the same time. The ion flux for Ge was 15 to 20 ma and was 35 to 40 ma for Mg. About 40 mg of enriched Ge isotopes and 25 mg of Mg isotopes were separated per hour. The investigations were made with metallic Ge and with MgI_2. The degrees of enrichment attained are tabulated. (J.S.R.)

10787

MEASUREMENT OF WEAK ION CURRENTS IN A MASS-SPECTROGRAPH USING AN IONIZATION CHAMBER. G. D. Tantsyrev and V. L. Tal'roze. Pribory i Tekh. Ekspt. No. 5, 51-3(1957). (In Russian)

A system is described for the measurement of weak ion currents in a mass spectrograph. The system uses gas multiplication. The ion current is transformed at a nickel target into an electron current and is then amplified in an ionization chamber. Ions having an energy of 2 kev are admitted through a collecting slit, accelerated between two electrodes up to 20 kev, and then impinged on a nickel plate. The coefficient of secondary emission is practically independent of energy above 7 kev and is equal to 4.3 for H_2O^+ ions. The secondary electrons are accelerated by an electric field into the ionization chamber which is at ground potential. A cylindrical ionization chamber is used. Measurements have shown that when the chamber is filled to a pressure of 44 mm of Hg and at ion currents of the order of 10^{-12} amp the curve of the current through the ionization chamber as a function of the potential difference between the electrodes has a plateau beginning at 5 v. The coefficient of amplification of the system as a function of the energy of the electrons at various pressures is shown. The stability of the amplification coefficient was found to be ±2%. It is believed that when the electrons pass through the chamber window, they are strongly scattered and therefore enter the chamber at an angle to the central collecting electrode. For this reason, it is suggested that higher amplification coefficients would be obtained if the diameter of the chamber were increased. By using a Geiger tube instead of an ionization chamber, the system can be used to count individual ions. (J.S.R.)

10788

PREPARATION OF ISOTOPE TARGETS IN AN ELECTROMAGNETIC SEPARATOR. M. I. Gusev. Pribory i Tekh. Ekspt. No. 5, 112-13(1957). (In Russian)

The possibility of preparing isotope targets by bombarding targets with ions having an energy of a few tens of kev depends on the fact that the bombarding ions penetrate into the target through a distance corresponding to approximately 100 atomic layers where they are slowed down and stopped. Curves of the dependence of the coefficient of cathode spattering N on the energy of bombarding ions for the following combinations of targets and ions are given: Ag-Ag^+, Ag-Ge^+, and Cu-Cu^+. The curves tend to saturation values as the ion energy increases which can be explained by the penetration of fast ions through the surface layer of the target. The depth of penetration is proportional to the energy of the ions. Experiments have shown (e.g., in the case of the copper target bombarded by silicon ions) that it is possible to obtain deposits with concentrations of the order of a few hundred micrograms per cm^2. Targets of Si^{28}, Si^{29}, and Si^{30} with concentrations of 500 to 300 micrograms per cm^2 were obtained. These targets were used in studies of (p,γ) reactions. Targets were found to be stable under proton beams having energies of the order of 2 Mev. (TCO)

10789

MASS-SPECTROMETRIC ISOTOPE ANALYSIS OF SOLID SUBSTANCES IN MS INSTRUMENTS. L. Ye. Levina. Pribory i Tekh. Ekspt. No. 5, 114-16(1957). (In Russian)

Isotope analysis of many solids can be made on their gaseous form. Surface ionization and electron bombardment have been considered. The experience reported here relates to direct heating of solid samples in the MC type instrument. The evaporator consists of a thin (less than 0.05 mm) sheet of a comparatively nonfusible metal, usually tantalum. This is bent into a "top-hat" section and the substance placed within after mixing to a paste in a solvent which does not influence the results. The results of work on the elements Fe, Zn, Cu, Mg, Ni, Cr, Pb, and Sb are tabulated. In the case of Fe, $FeCl_2$ is used and may easily be oxidized to the more volatile $FeCl_3$; this is prevented by adding some $ZnCl_2$ as a reducing agent. In other cases, the electrolytic properties of materials may cause difficulty. (TCO)

10790

A MASS SPECTROMETRIC ION SOURCE WITH SURFACE IONIZATION. B. G. Safronov, Yu. S. Azovskiy, and G. G. Aseyev. Pribory i Tekh. Ekspt. No. 6, 80-2 (1957). (In Russian)

Ion sources using the phenomenon of surface ionization have a number of advantages over thermionic sources. One of the major disadvantages of the surface ionization type of source is the loss of matter by evaporation since the surfaces lose not only ions but also neutral molecules in consequence of which the isotopic composition is affected. In the present source, the ionizing filament is surrounded by a cylindrical tube emitting vapor of the substance. The tube has a slit in it through which the ions can be emitted. The substance under investigation is deposited on the inner surface of the tube. When the central filament is heated (by a current produced by an accumulator) the tube surrounding it becomes hot, the coating slowly evaporates, and its molecules dissociate into atoms on the hot filament. The atoms are, in turn, ionized and then drawn out through the slit by an accelerating field. The emitted

ion beam can then be analyzed according to particle mass. Substances of the order of 5×10^{-7} g have been detected, using such a source. (TCO)

Mathematics

Refer also to abstract 11076.

10791 HW-53504 C
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
AN INTRODUCTION TO BOOLEAN ALGEBRA. A. A. Maupin, Jr. May 12, 1958. 24p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

A simple and elementary account of Boolian algebra is presented and illustrated with relay contact diagrams familiar to all engineers. Basic postulates and theorems, notation, DeMorgan's inversion theorem, duality, and the maxterm-minterm concept are discussed, leading to an introduction to Veitch diagrams for two, three, and four variables. (auth)

10792 KAPL-M-ELW-7
Knolls Atomic Power Lab., Schenectady, N. Y.
MULTIGROUP REACTIVITY BOUNDS. E. L. Wachspress. May 9, 1958. 13p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

A method is developed for determining bounds on reactivity for multigroup problems without recourse to the usual flux and fission source calculations. The method should be first attempted on one-space-dimension studies so that the analysis is restricted to this case. Theoretical extension to two dimensions may be feasible. (auth)

10793 RM-204(RAND)
RAND Corp., Santa Monica, Calif.
NOTE ON THE SOLUTION OF CONVEX GAMES. L. S. Shapley. Aug. 2, 1949. 5p.

In the process of obtaining a solution to a convex game it is in general necessary to select from an arbitrary set $\{f_\alpha\}$ of linear functions having the property $(\min/y \in B)\ (\sup/\alpha)\ f_\alpha(y) = c$, a finite subset with the same property. When y varies over a one-dimensional convex region B, the selection is trivially accomplished, basically because the unit sphere in one dimension consists of two separate points. A selection method is given for convex regions B of arbitrary finite dimension. (auth)

10794 SCTM-201-54-51
Sandia Corp., Albuquerque, N. Mex.
DETERMINING ALLOWABLE TEST SET ERRORS. J. M. Wieson and C. R. Clark. Sept. 1, 1954. 44p. Contract [AT(29-1)-789]. $7.80(ph OTS); $3.30(mf OTS).

A method is illustrated for determining the placing of test specification limits with respect to performance specification limits when errors of measurement exist. The method is applied to the case of normal (Gaussian) product distribution and normal test-set-error distribution and the performance specification limits set at $\pm 2\sigma$ of the product distribution from the nominal product value. Graphs are provided under these assumptions for determining the allowable test set error, the Consumer's Risk (probability that an item is nonacceptable and yet judged acceptable), and the Producer's Risk (probability that an item is acceptable and yet judged nonacceptable) involved for various settings of the test specification limits with respect to the performance specification limits. A test set error demonstrator (a pin-ball type apparatus) constructed at Sandia Corporation to demonstrate information of the type contained in the graphs mentioned above is described and evaluated. (auth)

10795 AEC-tr-3225
CONTRIBUTION TO THE USE OF MATHEMATICAL STATISTICS IN THE STEEL INDUSTRY. (Beitrag zum Einsatz der Mathematischen Statistik in der Eisenindustrie.) Kurt Orths. Translated from Stahl u. Eisen 78, 14-21(1958). 39p.

Some examples of application of mathematical statistics to specific situations in the steel industry are given concluding a general discussion. (T.R.H.)

10796
COULOMB WAVE FUNCTIONS. A. Learner and B. A. Robson (Univ. of Melbourne). Australian J. Phys. 2, 138-42(1958) Mar.

A table of values for f_L and f'_L is given for $\eta \leq 10$, $L = 5, 6, 10$, and 11, $\Delta\rho = 1$, and $\Delta\eta = 1$. (W.D.M.)

10797
NON-LINEAR FUNCTION GENERATORS WITH TWO INPUTS. A. I. Manukhin, A. A. Fel'dbaum, and L. N. Fitsner. Pribory i Tekh. Ekspt. No. 4, 33-8(1957).

The design of a two-input, non-linear function generator which produces an output $y = f(x_1 x_2)$, where x_1 and x_2 are the input voltages, is given. The principles of operation and the results of tests on the circuits are described. Change from one function to another is not complicated and is obtained by a system of hand controls. (TCO)

10798
ON FORCE-FREE MAGNETIC FIELDS. S. Chandrasekhar and L. Woltjer (Univ. of Chicago). Proc. Natl. Acad. Sci. U. S. 44, 285-9(1958) Apr.

The possibility that cosmic magnetic fields, which occur in regions of low density, may be force-free is considered. This theory raises the questions of whether a magnetic field in an isolated piece of highly ionized matter (in the absence of external forces) tends to a force-free state from an arbitrary initial state and how α, a function of position, becomes determinate. These questions, from a general point of view, are considered. The condition for maximum magnetic energy for a given mean-square current density, the case of an isolated spherical plasma, and the state of minimum dissipation for a given magnetic energy are discussed. (J.S.R.)

10799
THEORY OF RANDOM FUNCTIONS AND ITS APPLICATION TO THE PROBLEMS OF AUTOMATIC CONTROL. V. S. Pugachev. Moscow, Gosudarstvennoye Izdatel'stvo Tekhniko-Teoreticheskoy Literatury, 1957. 659p. (In Russian)

A systematic presentation of the applied theory of random functions and of probability methods in the theory of automatic control is given. The book is intended for scientists and engineers dealing with automatic controls and with the automatization of various branches of production. (J.S.R.)

Measuring Instruments and Techniques

Refer also to abstracts 10324, 10353, 10458, 10723, and 11202.

10800 AED-BRD-2
Marburg, Germany. Universität. Physikalisches Institut.
SZINTILLATIONS-MESSKOPF. (Scintillation Measuring Devices). No. G 1. 1956. 10p., 2 illus.

Specifications and engineering drawings of a scintil-

lation counter for nuclear radiation are presented. (J.S.R.)

10801 AED-BRD-4
Marburg, Germany. Universität. Physikalisches Institut.
10^4–FACH ZÄHLGERÄT (10^4 ZG). (10^4 Counting Apparatus (10^4 ZG)). No. G 5. 1956. 12p., 3 illus.
Specifications and engineering drawings for a 10^4 counting apparatus designed to count the electrical signals delivered by a measuring device are presented. (J.S.R.)

10802 AED-BRD-38
Marburg, Germany, Universität. Physikalisches Institut.
KLEINES HOCHSPANNUNGS-REGELGERÄT ("MULTIPLIER-VERSORGUNGSGERÄT") STAB. 3. (Small High Voltage Regulator ("Multiplier Supply Apparatus") Stab. 3.) No. G 16. 1957. 14p., 4 illus.
Specifications and engineering drawings for a small voltage regulator designed to provide a scintillation detection instrument with high-potential operating voltage are presented. (J.S.R.)

10803 BLG-19
Brussels. Centre d'Étude de l'Énergie Nucléaire.
SUR UNE AMELIORATION DES MESURES ABSOLUES ET COMPARATIVES DES DENSITES EN NEUTRONS THERMIQUES OBTENUES AU MOYEN DES EMULSIONS NUCLEAIRES A CHARGE REDUITE EN BORE PAR ANALYSE QUANTITATIVE DE LA CHARGE. (On an Improvement of the Absolute and Comparative Measurements of the Thermal Neutron Densities Obtained by Means of Nuclear Emulsions with Reduced Charge in Boron by Quantitative Analysis of the Charge.) C. Beets, H. Breny, and J. Fournaux. Jan. 20, 1958. 23p.
When boron loaded nuclear emulsions are used for absolute measurement of thermal neutron densities, it is necessary to determine their boron content. Two methods of effecting this determination are proposed; one is absolute, the other is relative. Both are valid for small values of the boron content. Moreover, it is shown that the precision of absolute measurements is increased when due regard is paid to the values of the boron content. (tr-auth)

10804 CRP-755
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
FINITE GEOMETRY CORRECTIONS TO GAMMA-RAY ANGULAR CORRELATIONS MEASURED WITH 5 IN. DIAMETER BY 4 IN. LONG NaI(Tl) CRYSTALS. H. E. Gove and A. R. Rutledge. Feb. 1958. 27p.
Corrections for finite angular resolution to be applied to angular correlations of gamma rays measured with 5 in. diam. by 4 in. long NaI(Tl) crystals were calculated on the Chalk River Datatron computer using formulas derived by Rose. The corrections are expressed as attenuation factors J_l/J_O which are the fractional decrease in the coefficient a_l of the Legendre polynomial expansion $W(\theta) = \Sigma_l a_l P_l$ (cos θ) representing the true distribution caused by the finite size of the detector. The functions are both tabulated and plotted for a number of distances between the front face of the crystal and the point source of gamma rays for gamma-ray energies between 0.1 and 10 Mev. In addition, plots of the absorption coefficient vs. gamma-ray energy and calculated efficiency vs. gamma-ray energy for a number of distances between detector and target are given, again for 5 in. by 4 in. NaI(Tl) crystals. (auth)

10805 INS-TCA-11
Osaka Univ.
A STUDY OF THE HODOSCOPE CHAMBER II. A PRELIMINARY STUDY OF A NEW DEVICE OF A PARTICLE DETECTOR. (In Japanese–abstract in English). Shuji Fukui and Sigenari Miyamoto. Apr. 10, 1958. 10p.
Discharges occurring in such tubes as Conversi counters were investigated with respect to their dependence on the intensity of the pulse field, on the time delay of the applied pulse, and on the wave form of the pulse. Moreover, a preliminary test for a new detector suggested in a previous paper (INS-TCA-10) was conducted by using tubes of 2 cm diameter filled with the mixture (Ne + 0.1% Ar) at 50 cmHg. Diffusion of discharges from a particle trajectory was found to depend mainly on the time width of the applied high voltage pulse. In order to develop discharges corresponding correctly with the trajectory, the time width of the pulse must be made shorter than 10^{-7} sec. Photographs of tracks of cosmic ray particles obtained with this instrument are shown. (auth)

10806 NAA-SR-2040
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
A RADIATION GAUGE FOR INSPECTION OF OMRE FUEL PLATES. H. Schlein. May 1, 1958. 20p. Contract AT(04-3)-88. $0.75(OTS).
A gage is described which was designed to detect variations of UO_2 content in the stainless-steel matrix of the OMRE fuel plate core. A cerium-144 source is used with a scintillation detector, digital counter, and auxiliary instrumentation. It is shown that, for the specified application and prescribed method of operation, the equipment will easily detect 2% relative variations of UO_2 concentration. Absolute calibration was not obtained. Spot sampling is proposed as a practical inspection, considering that reading periods are of the order of one minute per location. (auth)

10807 NRL-5083
Naval Research Lab., Washington, D. C.
A TWO-METER POSITIVE-ION BEAM ELECTROSTATIC ANALYZER. R. O. Bondelid and C. A. Kennedy. Dec. 3, 1957. 75p. Project NR-540-000.
An electrostatic analyzer with a radius of curvature of two meters and a deflection angle of 90° was constructed, installed, and evaluated. It is used in conjunction with the NRL large Van de Graaff accelerator to provide a positive-ion beam of precisely known and highly resolved energy. The analyzer was used to determine the bombarding energies of several (p,γ) resonances and (p,n) thresholds. It was also used to determine the widths of some very narrow (p,γ) resonances. (auth)

10808 UCRL-5167
California. Univ., Livermore. Radiation Lab.
NEUTRON REMOTE AREA MONITORING SYSTEM. Charles W. Appleby. Apr. 25, 1958. 8p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).
The Neutron Remote Area Monitoring System affords the Health Physics Department a method of maintaining a permanent record of neutron levels in areas occupied by personnel. Such a record is useful in determining maximum dosage for personnel as well as a reference guide for the operators of the equipment that produces the fast neutrons. Equipment and operating procedures are described. (C.H.)

10809 USNRDL-TR-230

Naval Radiological Defense Lab., San Francisco.
IMPROVED PLASTIC WELL SCINTILLATORS FOR BETA COUNTING. E. A. Boling. May 1, 1958. 26p.

Plastic-well scintillators have recently been proved useful for counting beta particles. Two improved counters of this type are described. These improved counters have, respectively, four and ten times the sensitivity for K^{42} of the counters mentioned above. These increases in counter sensitivity have been achieved by increasing the sensitive volumes of the counters so that the plastic sample tubes used could be completely filled with radioactive solution, instead of containing only a fraction of this volume, as has been the practice. In addition, design modification is introduced which greatly simplifies the manufacture of such scintillators. (auth)

10810 WCLT-TM-58-66

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
SIXTH MEETING OF THE ANP ADVISORY COMMITTEE FOR NUCLEAR MEASUREMENTS AND STANDARDS. R. E. Brocklehurst, R. L. Hickmott, L. A. King, G. Wepfer, and P. B. Hemmig. Apr. 7, 1958. 35p. Project 6002.

The present status of the WADC Materials Laboratory dosimetry program is summarized. Progress made by Convair and Lockheed on the graphite ion chamber design is presented. The calorimeter used to calibrate the Lockheed ion chamber is discussed. The proposed distribution for irradiation of Convair's chlorinated hydrocarbon dosimeters is discussed. The Materials Laboratory proposed program on foils and the anticipated difficulties in foil dosimetry for the WADC reactor are presented. The proposed instrumentation and an adiabatic calorimeter in use at Lockheed are discussed. Dose measurement concepts, in particular hydrogen dose, are mentioned. Why both foil measurements and water dose measurements might be useless for correlating radiation damage due to fast neutrons is explained. The work in progress and being planned on degraded luminophors is presented. The BMI contract with the Materials Laboratory to find a high intensity gamma ray dose measurement system is discussed. Shielding tests at Convair using foils for the neutron measurements are described. (M.H.R.)

10811

RECENT DEVELOPMENTS OF GLASS DOSIMETRY FOR SOFT ROENTGEN RAYS. PART I. Thormod Henriksen and Tor Brustad (Norwegian Radium Hospital, Oslo). Am. J. Roentgenol. Radium Therapy Nuclear Med. 80, 117-21(1958) July.

An investigation of a glass dosimeter for soft x rays was carried out. The dose was determined from the radiation induced colorization in soda-silicate glass coverslips. Special efforts were made to make the results independent of glass thickness. The energy dependence of the dosimeter system was studied for 35 kev x rays with half-value layers ranging from 0.1 to 1.3 mm Al. (auth)

10812

A PORTABLE RADIOMETER ANALYZER. G. R. Gol'bek, V. V. Matveyev, and R. S. Shlyapnikov. Atomnaya Energiya 3, 247-50(1957).

The electronic wiring circuit and the mechanical structure of a newly constructed portable (2.5 kg) radiometer analyzer is described, by means of which it is possible to describe the radium–thorium content (> 0.01%) of a rock. Two measurements are possible: Recording of γ radiation and determination of its intensity, and analysis of the spectral composition of γ radiation, from which it is possible to draw conclusions as to the nature of the rock investigated. By means of the device described it is possible to determine γ intensities of from 3 to 15,000 mc/h and to carry out the spectral analysis of the γ spectrum if the γ intensity is within the range of from 50 to 5000 mc/hr. (TCO)

10813

OBSERVATION OF CHARGED PARTICLE TRACES IN AN ALCOHOL–STEAM MIXTURE. Yu. L. Sokolov. Atomnaya Energiya 3, 544-5(1957).

Even in cases in which a supersaturation does not exist in diffusion chambers the particle causes an optical inhomogeneity at which light scattering might occur. In order to investigate this assumption, the working volume of an expansion chamber was filled with air, saturated at 7°C by water and alcohol vapor under 2 atm. pressure. It was illuminated by a mercury capillary lamp (1 kw), the luminous flux of which was 60,000 lumen. The results obtained do not permit unmistakable conclusions on the character of the optical inhomogeneity which is caused by the charged particles. The light scatter might originate from drops of condensation suddenly developing. But for the inhomogeneity an impulse wave which is formed as a consequence of the rapid energy release in a small space along the particle courses could be significant. Further experiments for the explanation of the mechanism of formation are necessary. (TCO)

10814

MEASUREMENT OF γ-RAY AND NEUTRON SPECTRA WITH CsI(Tl), NaI(Tl), AND STILBENE CRYSTALS. N. G. Afanas'ev and V. Iu. Gonchar. Atomnaya Energiya 4, 289-92(1958) Mar. (In Russian)

Measurements of γ-ray and neutron spectra were made in the installation consisting of a scintillation crystal, a photomultiplier, linear pulse amplifier, stabilized source of high intensity for photomultiplier feed, and multichannel amplitude pulse analyzer. A compact scheme of specially developed amplifier and stabilized feed multiplier is given. Prepared crystals of CsI(Tl), NaI(Tl), and stilbene of 3 cm in diameter and 2 cm long were used for the measurement of the gamma-ray spectra and inelastic neutron scattering of Cs^{137} and Co^{60}, as well as for the spectra of proton recoil from neutrons at 3.1 Mev. (R.V.J.)

10815

DECAY TIME OF THE LUMINESCENCE OF A ZINC SULPHIDE NEUTRON DETECTOR FOR NEUTRON AND γ-RAY EXCITATION. G. M. Bailey (Univ. of Melbourne) and J. R. Prescott (Australian Atomic Energy Commission and Univ. of Melbourne). Australian J. Phys. 2, 135–8(1958) Mar.

The neutron detector consists of ZnS(Ag) molded in a lucite cylinder 1 in. in diameter by $\frac{3}{4}$ in. thick, mounted directly on the face of a photomultiplier. The decay time for gamma excitation was determined from a measurement of the integrated pulse-rise time. Pulse-rise times were determined photographically from a short-time exposure spectrum. (W.D.M.)

10816

PORTABLE INSTRUMENTS FOR MONITORING OF β-RAYS. V. K. Resh and Ye. Ye. Donal'dson. pp. 121-31 in Dozimetriya Ioniziruyushchikh Izlucheniy. Moscow, Gostekhteoretizdat, 1956. (Translated from Referat. Zhur. Elektrotekh. No. 3, 1957, p. 168)

Several β- and γ-radiation dosimeters using an ioni-

zation chamber as the detector and a scintillation counter with a sensitive scintillator are described.

10817

RECENT PROGRESS IN THE FIELD OF SCINTILLATING COUNTERS. G. A. Morton. pp. 132–67 in Dozimetriya Ioniziruyushchikh Izlucheniy. Moscow, Gostekhteoretizdat, 1956. (Translated from Referat. Zhur. Elektrotekh. No. 2, p. 180, 1957.)

Detailed data on contemporary photo multipliers and scintillation counters are given. The utilization of the scintillation counter for energy-spectra and time-interval measurements and as a sensitive radioactive radiation monitor is discussed. (39 references). (TCO)

10818

TECHNIQUE AND MEASUREMENT OF RADIATION BACKGROUND IN ALBUQUERQUE, NEW MEXICO, DURING AND AFTER THE TEAPOT SERIES. H. H. Sander and T. B. Cook, Jr. (Sandia Corp., Albuquerque, N. Mex.). IRE Trans. Nuclear Sci. NS-5, No. 1, 17–19 (1958) June.

Radiation background intensity was monitored on a continous, 24-hour basis. The techniques used are described. As an example, the increase in total dose received due to the Teapot tests over what the dose would have been had there been no tests, is determined to be 4.5 mr. (auth)

10819

METROLOGIC WORK IN THE FIELD OF IONIZING RADIATIONS. K. K. Aglintsev and A. S. Karamyan. Izmeritelnaya Tekh. No. 6, 85–91(1957). (In Russian)

A brief review is given of the work done by the All-Union Scientific Research Institute of Metrology imeni Mendeleyev. A description is given of the laboratory's equipment. (J.S.R.)

10820

PREPARATION OF ALKALI-HALIDE PHOSPHORS FOR SCINTILLATION COUNTERS. L. M. Shamovskii, L. M. Radionova, and A. S. Glushkova. Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 22, No. 1, 3–11(1958) Jan. (In Russian)

10821

INVESTIGATION OF SCINTILLATORS CONTAINING ORGANIC BORON COMPOUNDS. A. N. Nikitina, M. D. Galanin, P. M. Aronovich, T. A. Shchegoleva, and B. M. Mikhailov (Lebedev Inst. of Physics, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 22, No. 1, 12–13(1958) Jan. (In Russian)

A series of organoboron compounds was prepared and analyzed to determine their scintillation intensity in recording slow neutrons and their effects on the performance of the scintillator. The intensities of scintillating mixtures of p-terphenyl and organoboron compounds in 1:1 ratio were tabulated. It is shown that the alkyl ethers and dialkyl boron acids have a small effect on the p-terphenyl γ-scintillation intensity. The trimethyl borate lowers the scintillation intensity 50%, and aryl and diaryl ethers and boron acids lower the p-terphenyl scintillation capacity 50 to 90%. The organoboron compounds with aryl replacements possess very weak γ luminescence. (R.V.J.)

10822

RECORDING SCREENS FOR SLOW NEUTRONS. T. V. Timofeeva and S. P. Khormushko. Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 22, No. 1, 15–20(1958) Jan. (In Russian)

Descriptions are given of the design and performance of scintillators based on the (n,α) reaction in boron for recording slow neutrons with a strong gamma background. Luminescent materials with zinc sulfide base were used for counting α particles. Studies were made of the best methods and conditions for preparation of luminescent materials. The effects of layer thickness, grain dimensions, and the media in which the luminescent material is immersed are discussed, and the most effective shape for the recording screen is determined. (R.V.J.)

10823

PLASTIC SCINTILLATION DETECTORS. I. M. Rozman. Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 22, No. 1, 36–40(1958) Jan. (In Russian)

A review is given of preparation and performance of plastic scintillation detectors. 36 references. (R.V.J.)

10824

ON THE μ-MESON TELESCOPE USING PLASTIC SCINTILLATORS. Shinkichi Kawasaki and Yukio Miyazaki. J. Sci. Research Inst. (Tokyo) 52, 1–10(1958) Mar.

A μ meson detector using plastic scintillators has been constructed for the observation of cosmic rays in the Japanese Antarctic Research Expedition. The design and performance of the telescope are described and some preliminary experimental results are discussed. (auth)

10825

ON THE HYSTERESIS EFFECT OF MICA END-WINDOW GEIGER-MÜLLER COUNTER TUBES. Juichi Akutsu. J. Sci. Research Inst. (Tokyo) 52, 11–16(1958) Apr.

Geiger-Mueller tubes with metal envelopes having mica end windows coated externally with a conductive material cause a hysteresis effect which is evidenced by the difference in counting rates when the voltage in the plateau region is transversed in ascending and descending directions. This hysteresis effect is eliminated by use of an opaque varnish film in place of the conductive material. (auth)

10826

PROTECTIVE MEASURES AGAINST RADIATION BY THE METHOD OF FILM BLACKENING. F. Wachsmann. Minerva nucleare 2, 92–3(1958) Mar. (In Italian)

A brief review is given of the advantages of the use of film badges for the control of radiation received by persons working with radiation and radioisotopes. (J.S.R.)

10827

RADIOACTIVITY OF PLANT MATERIAL COLLECTED AFTER THE ACCIDENT AT WINDSCALE NO. 1 PILE. G. Kimber and A. Booth (Univ. of Manchester, Eng.). Nature 181, 1391–2(1958) May 17.

Samples of vegetation were collected in the vicinity of the Windscale plant on the eight and twenty-fifth days following the reactor accident on Oct. 10, 1957. Data are tabulated on the level and nature of the radioactivity present in the vegetation as determined by radiometric analysis of dried material. (C.H.)

10828

ACCUMULATION OF RADIOACTIVE FALL-OUT BY PLANTS IN THE ENGLISH LAKE DISTRICT. Eville Gorham (Freshwater Biological Assn., Ambleside, Westmorland, Eng.). Nature 181, 1523–4(1958) May 31.

Samples of vegetation were collected in the vicinity of the English Lake District during early 1958. Data are presented on the level of radioactivity present in the vegetation. A comparison is made with data on the radioactivity of vegetation collected in 1957, prior to the Windscale reactor accident on Oct. 10, 1957. (C.H.)

10829

PHOTO-IONIZATION IN SELF-QUENCHING GEIGER COUNTERS. Rafi M. Chaudhri, Mustafa Yar Khan, Abida Khawaja, and Rehana Dar (Government Coll., Lahore, West Pakistan). Nature 181, 1526-7(1958) May 31.

The ultraviolet radiations produced from excited argon atoms in a Townsend avalanche are quite energetic and may give rise to photo-ionization of polyatomic gas of the filling mixture in a self-quenching Geiger counter. Effects on counter operation are discussed. (C.H.)

10830

HODOSCOPE. Nauka i Zhizn No. 8, 19(1957). (In Russian)

A brief description is given of the hodoscope installation in the Lenin Mountains. The installation is made up of more than 4,000 measuring devices and approximately 12,000 tubes with cold cathodes located in 15 laboratories. (J.S.R.)

10831

PHOTOGRAPHIC RECORDING METHODS IN NUCLEAR PULSE SPECTROMETRY. D. Maeder (E.T.H., Zurich). Nuclear Instr. 2, 299-331(1958) May.

Applications of photographic techniques as a tool in measuring pulse amplitude (PA) distributions fall into 3 general groups: (1) Recording of individual events as they arrive from the nuclear radiation detector, with subsequent analysis based on visual or photoelectric inspection of the record. (2) Time exposures of a large series of events, the distribution analysis being provided by the exposure-density correspondence in the photographic process. (3) Use for permanent storage of results from counting equipment, after the pulse sorting has been performed electronically. The first and third groups are reviewed and some improvements of existing techniques suggested. For the second group a thorough presentation of design problems and evaluation procedures is attempted. Gray wedge (GW) techniques lead to a straightforward quantitative interpretation of photographed PA spectra. The simplest version of a fast GW spectrometer consists of a commercial oscilloscope and a special plug-in adaptor unit. The adaptor described provides double rectangular pulse shaping, various shape corrections, overload protection, and generates an exponential sawtooth voltage derived from the linear oscilloscope sweep. This simple GW spectrometer is particularly useful at high counting rates. For a more general use (at both high and low intensities) additional parts such as pulse stretchers, gating circuits and various sweep or wedge arrangements are needed. Stretching and gating requirements are discussed from a general point of view. Various methods of producing GW effects are reviewed and the calculated wedge characteristics and light efficiencies compared. The high speed at which information from electronic counting equipment may be accepted for permanent storage on film makes the use of photographic techniques particularly attractive for automatic recording. Programming of a serial memory spectrometer including dead time correction is described. A scanning mechanism is proposed to read previous results back into the spectrometer memory, with provision for semi-automatic computation of linear combinations. (auth)

10832

ON A SET OF PERMANENT MAGNET BETA-RAY SPECTROMETERS. Hilding Slätis (Nobel Inst. of Physics, Stockholm). Nuclear Instr. 2, 332-41(1958) May.

The advantages of the use of a set of at least three permanent magnet beta-ray spectrometers, each spectrometer designed for a certain energy interval, are emphasized. It is found that a design which gives good homogeneity for strong magnetic fields might fail to do so for weak ones. A simplified construction of high resolution spectrometers is given. Reproduction of conversion line spectra of ThB + C + C″ and of $Hg^{195,195m,197,197m}$ illustrate the efficiency of the spectrometers. The suitability of a high resolution permanent magnet beta-ray spectrometer for use also in the low energy region (about 6–15 kev) is demonstrated by a record of more than 50 L-Auger lines in the electron spectrum of ThB + C + C″. (auth)

10833

SIMPLE ČERENKOV DETECTOR FOR THE MEASUREMENT OF THE ENERGY OF RELATIVISTIC CHARGED PARTICLES. M. Huq (Univ. of Birmingham, Eng.). Nuclear Instr. 2, 342-7(1958) May.

A detector using a cone-shaped perspex radiator for the measurement of the energy of protons from a proton synchrotron is described. The over-all resolution obtained was ±13% most of which is contributed by the sensitivity of the detector to the width and angular spread of the beam. With ideal beam conditions the resolution is expected to be ±6%. (auth)

10834

A GENERAL PURPOSE DIRECT CURRENT IONIZATION CHAMBER. J. P. Keene, L. A. Mackenzie, and C. W. Gilbert (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Phys. in Med. Biol. 2, 360-73(1958) Apr.

A large re-entrant ionization chamber which can take sources up to 15 in. long and 7 in. in diameter is described. It has been in use for several years for gamma measurements and an account of its clinical and research applications is given. The performance of the chamber with regard to accuracy and long term stability is described in detail and some measured values of the half-lives of I^{131}, I^{132}, Co^{60}, Fe^{59}, Ta^{182}, and Au^{198} are included. (auth)

10835

EXPERIMENTAL DETERMINATION OF THE EFFICIENCY OF A GAMMA SCINTILLATION SPECTROMETER. R. A. Ricci (Instituto di Fisica sperimentale del Politecnico, Turin). Physica 24, 289-96(1958) Apr.

An experimental method for the determination of the crystal efficiency in gamma scintillation spectrometry is described. It consists essentially in measuring the photopeak areas of the different scattered radiations producted in an Al scatterer by a beam of monochromatic gamma rays. The number of the primary photons impinging upon the scatterer is known from the intensity of the source and from the geometry. If E_0 is the primary photon energy it is possible to determine: (1) the energy of the scattered collimated beam as a function of E_0 and of the direction θ; (2) the number of photons entering the crystal as a function of the primary intensity, of the angle θ and of the geometry; (3) the crystal efficiency. The experimental apparatus and the results obtained for a 2 × 2 cm NaI (Tl) crystal are reported. The validity of the method is discussed. (auth)

10836

IONIZATION CHAMBERS FOR ALPHA PARTICLE COUNTING. S. S. Bugorkov, L. Z. Malkin, K. A. Petrzhak, V. A. Yakovlev, and M. I. Yakunin. Pribory i Tekh. Ekspt. No. 4, 16-19(1957).

The construction and properties of 5 ionization chambers for alpha particle counting are described. The

first is a universal camera for alpha particles emitted within a solid angle of 2π. This camera is used for measurements on alpha-active materials deposited on one or both sides of a thin plate. It can also be used to estimate the degree of alpha-activation of the inner surfaces of hemispherical platinum cups after various chemical procedures. The second is a camera for measurements in a solid angle which is less than, or equal to, 2π. No. 3 is a camera for measuring alpha activities of liquids. The fourth is a camera with a solid angle $(0.01 - 0.001) \times 2\pi$. The last is an argon filled camera. This is used to measure intensities of the order of 2×10^5 counts/min and also in the measurement of alpha activity on a high beta background. The pressure of the argon is about 1 atm. The mechanical design of the 5 chambers is shown. (TCO)

10837

DETECTION OF DISINTEGRATION FRAGMENTS AND CHARGED PARTICLES BY THIN SCINTILLATION FILMS. V. M. Gorbachev and M. I. Kazarinova. Pribory i Tekh. Ekspt. No. 4, 20-4(1957).

The design of a disintegration fragment detector based on an application of thin scintillation films is presented. Terphenyl anthracene and 2.5 diphenyloxazol in various concentrations in polystyrene were used. The solution was transferred by means of a pipette on to a glass surface and was dried at room temperature for a number of hours. After the drying process, the film was easily detachable from the glass. To accelerate the drying process, the glass can be warmed to 50 to 60°C. A layer of U^{235} (1 mg/cm^2) placed in a beam of thermal neutrons was used as the source of disintegration fragments. The layer was placed in a vacuum chamber at a distance of 5 cm from the scintillation film. All the measurements were carried out using a photomultiplier collecting 100% of the photoelectrons. Pulses from the photomultipler were fed into an amplifier, integral discriminator, and then to a counting device. Detectors based on thin scintillation films have a resolving time of the order of 3×10^{-9} sec and can be used in fast coincidence schemes. It was found possible to detect disintegration fragments on a high alpha background. The efficiency of the detector for disintegration fragments and alpha particles is 100%. Their sensitivity to gamma rays and fast neutrons is low. Thin scintillation films with a deposited layer of Li^6 and U^{235} can be used as fast detectors of thermal neutrons. (TCO)

10838

APPLICATION OF A FILM-SCINTILLATOR SYSTEM FOR RECORDING OF GAMMA RADIATION. R. M. Kogan and N. K. Pereyaslova. Pribory i Tekh. Eksperim. No. 4, 25-7(1957).

A sodium iodide scintillator of the well type was covered with a film. Thus, the incident gamma radiation produces a blackening of the film both directly and also via the scintillations produced in the crystal. If the gamma ray intensity varies with time, it may be studied by passing a film continuously over the crystal. In this way, one obtains the gamma ray intensity as a function of time. It is shown that this system is 10^3 to 10^4 as sensitive as the conventional film detector. (TCO)

10839

AN INVESTIGATION OF THE DISTORTION PRODUCED IN NUCLEAR EMULSIONS BY THE INTRODUCTION OF THREADS INTO THEM. Yu. T. Lukin, Zh. S. Takibayev, and I. Ya. Chastnikov. Pribory i Tekh. Ekspt. No. 4, 27-9(1957).

There are a number of methods of introducing a material into an emulsion. The emulsion may be loaded with the material in the form of a suspension when still in the liquid state, a thin foil can be placed between prepared emulsion layers, and thin metallic threads can be placed into the emulsion when it is still in the liquid state. 660 ± 5 Mev protons were used to irradiate emulsions with and without metallic threads and the distortion was determined by comparing the scattering of these protons in the two kinds of emulsion. At the same time, the "scattering constant" for the emulsion NIKFI (type P) was determined. This was found to be equal to $27.4 \pm 1.5^\circ$ Mev $(100\ \mu)^{1/2}$. This value is in good agreement with the values obtained by other authors for the widely used Ilford G-5 emulsion. (TCO)

10840

A DETERMINATION OF THE SENSITIVITY OF PHOTOGRAPHIC EMULSIONS TO CHARGED PARTICLES. A. P. Zhdanov and L. I. Shur. Pribory i Tekh. Ekspt. No. 4, 29-31(1957).

The existing methods of estimating the sensitivity of photographic emulsions to charged particles do not give an absolute characteristic of the sensitivity. A method is described whereby the sensitivity of an emulsion is determined in terms of the energy loss which is necessary for a development of a grain, expressed in electron volts or ergs, or, for simplicity, in terms of the nu number of silver atoms. Using this method, emulsions having different sensitivity are compared. A quantitative approach to the problem of activation also becomes possible. Zhdanov's formula for the number of developed grains is used. This is of the form: $n = k\lambda M(\bar{d}_e/\bar{d})^2/\bar{d}$, where k is the coefficient depending on the density of AgBr, M is the concentration of AgBr in the emulsion in g/cm^3, λ is the length of path of the particle in the emulsion, $\bar{d}$ is the mean diameter of an undeveloped grain, and d_e is the effective diameter of a grain for the given particle. (TCO)

10841

MEASUREMENT OF SMALL ANGLES IN NUCLEAR PHOTOEMULSIONS. A. P. Zhdanov, I. B. Berkovich, F. G. Lepekhin, N. V. Skirda, and Z. S. Khokhlova. Pribory i Tekh. Ekspt. No. 4, 32(1957).

The problem of accurate measurement of angles between the primary and secondary tracks is associated with nuclear interactions of high energy particles with nucleons and nuclei in nuclear emulsions. These angles are of importance in the comparison of experimental data with theoretical predictions and in the study of multiple production of particles. A coordinate method which allows such a measurement to be made with sufficient accuracy is described. Formulas are given for the case when the beginning of the shower is outside the emulsion and for the case when the shower begins in the emulsion. (J.S.R.)

10842

INCREASING THE EFFICIENCY OF IONIZATION AND PROPORTIONAL COUNTERS. Ye. P. Ovchinnikov and S. S. Semenov. Pribory i Tekh. Ekspt. No. 4, 39-43 (1957).

Ionization and proportional counters are widely used in nuclear radiation studies. Small resolving power and low sensitivity are their main shortcomings. This is connected with the input circuit of the recording device. An ionization or proportional counter can be looked upon as a current generator with a very high internal resistance which is necessarily shunted by the capacitance of the radiation detector and the input capacity of the amplifier. A reduction in the shunting capacitance leads to an increase in the signal amplitude and a reduction in its length. A stable electronic scheme com-

pensating for the input capacitance of ionization cameras and proportional counters is described. An application of such a scheme reduces the input capacitance of the detecting device practically to zero in the frequency range of up to a few megacycles per second. The signal level and the resolution are thereby considerably increased. (TCO)

10843

AMPLITUDE ANALYZER WITH LOGARITHMIC CONVERSION. B. N. Moiseyev. Pribory i Tekh. Ekspt. No. 4, 43-5(1957).

An amplitude analyzer is described which is designed to work with a proportional counter in a magnetic spectrometer for cosmic particles. Due to logarithmic conversion of the pulse amplitude into time duration, measured by counting the number of cycles of a pulse-modulated generator, the relative error of measurement of the signal value is constant over the whole range of the measured impulses and the absolute accuracy of small signals is higher than for an analyzer having linear conversion. A circuit of the equipment is given together with theoretical waveforms. The input signal is gated and a capacitor is charged up to the amplitude of the pulse. After the gate, the capacitor discharges on a fixed time constant. The discharge is used to form a rectangular pulse, the duration of which is proportional to the logarithm of the input signal amplitude. This rectangular pulse modulates a 20 kc/s oscillator and the oscillations occurring during the duration of the rectangular pulse are squared and counted. (TCO)

10844

AN He^3-CAMERA FOR NEUTRON SPECTROSCOPY. N. P. Glazkov. Pribory i Tekh. Ekspt. No. 4, 86(1957).

The construction of an He^3-counter which registers neutrons from the reaction $He^3(n,p)T + 770$ kev with very good energy resolution (3%) in the region 0.1 to 1 Mev was described earlier. However, the construction of the counter is not simple enough for it to be easily carried out in laboratory conditions. A simpler construction is now described. The camera has a spherical form and its resolution compares well with the resolution of the cylindrical He^3 counter. The following data are given: diameter = 200 and 15 mm, capacitance of collecting electrode = 5 $\mu\mu$F, filling in mm of Hg = 350 (He^3) + 1,900 (Ar) + 90 (N_2), gas multiplication = 1, positive ion effect = 3 %, energy range = 0.1 to 1 Mev, wall effect = 10 to 30%, energy resolution for $E_H = 0$ is = ±4% ± 30 kev, and efficiency = 10^{-4}. (TCO)

10845

A FAST-ACTING DIFFERENTIAL COINCIDENCE CIRCUIT. Yu. K. Akimov. Pribory i Tekh. Ekspt. No. 4, 98-9(1957).

A description is given of a fast-acting differential coincidence circuit. The input elements of the apparatus are two coincidence circuits. Each of these is connected to two pulse detectors, one directly and the other via a delay cable. The result of such connections is that the output pulses of both circuits will be equal in amplitude at coincidence but different at non-coincidence. The difference in the pulses is obtained by the differential stage. After amplification, the difference pulse, which is the anti-coincidence signal, suppresses the pulse which is being transferred from one of the coincidence circuits to the counting apparatus. The result is that only coincidence pulses which are not accompanied by difference pulses are recorded. The circuit diagram is given. The circuit recorded the self-coincidence of pulses from a counter, which consisted of a photomultiplier B-1 and a solution of terphenyl in phenylcyclohexane, scintillating under the action of irradiation from Co^{60}. The photo-multiplier was loaded by a 75 Ω cable. The amplitude of the pulses was $\lesssim 0.5$ v. The self-coincidences were broken by cables of different lengths l. The count rate of the pulses in relative units were with l = 0, −1, with l = 5 cm, −0.3, with l = 10 cm, −0.02, and, with l = 10 cm, tended to zero, which corresponded to a time resolution $\sim 2 \times 10^{-10}$ sec. For recording coincidences from two scintillation counters, it is necessary to consider not only the time variation but also the amplitude variation of the coincident pulses. If this difference is not very great, then it can be limited to some value of the resolving time due to amplification of the discrimination of the difference signal. With large variation, it is necessary to make the signal symmetrical by using forming lines and to move these pulses relative to each other as measured on their half-widths. The circuit is primarily useful for analysis of fast particles with time-spans differing by $\Delta t \leq 10^{-9}$ sec. (TCO)

10846

THE EFFECT OF OVERLAP IN THE MEASUREMENTS OF TRACK DENSITY IN A BUBBLE CHAMBER. M. F. Lomanov and B. V. Chirikov. Pribory i Tekh. Ekspt. No. 5, 22-5(1957). (In Russian)

The possibility of measuring the ionization (track density) produced by charged particles in a bubble chamber was discussed and a method for carrying out such a measurement was proposed. Different methods of measuring the ionization are reviewed, and an analysis of the statistical errors involved is given. The track density is defined as the initial number of nucleating bubbles per unit length of track produced by a charged particle in the liquid. If the track density is sufficiently small, it can be determined by a simple count of the bubbles on a photograph of the track. In ordinary conditions, however, it is necessary to take into account random of overlap of the bubbles and thus a direct measurement of the track density is impossible. The following model is assumed. Images of the bubbles are circular and all have the same diameter d. The centers of these bubbles are randomly distributed along a straight line with a mean density g. The distribution of the distances x between the centers of the bubbles is Poissonian and is therefore of the form: $w(x)dx = g.\exp(-gx)dx$. When overlapping occurs, a track consists of clusters and gaps. The integral distribution of gap length can be derived from the Poissonian distribution and has the form $P(l) = \exp(-gl)$. The following methods are considered: gap distribution, mean gap size, and transparency of the track. The last is defined as the mean ratio of the total length of all the gaps greater than l_0 and the length of the track. It is shown that when gd' is less than 2, the method of the "transparency of the track" is most convenient, and for gd' greater than 2, the method of "number of gaps" is suitable. (TCO)

10847

A FAST METHOD OF SCANNING OF NUCLEAR PHOTO-EMULSIONS. V. A. Petukhov. Pribory i Tekh. Ekspt. No. 5, 26-30(1957). (In Russian)

A "flying spot" method of scanning photo-emulsions is described. The instrument is shown schematically. A micro-oscillograph of suitable dimensions and low persistence is placed above a photo-emulsion to be scanned and a normal television scanning regime is established. An image of the "flying spot" is produced within the emulsion by means of a lens system. This

image is recorded by a photomultiplier placed under the emulsion. When the "flying spot" strikes a silver grain, a partial scattering of light takes place and a signal appears across the load of the photomultiplier. This signal is amplified and converted into a standard form and is then supplied to a second, large screen oscillograph having a long persistence. The two oscillograph screens are scanned in phase and therefore all the grains lying at a depth σ within the photo-emulsion appear as points of light on the large screen of the second tube. An increase of the depth of view is obtained because the magnification of the optical system is low. It was found to be possible to show on a television screen on a magnified scale all the tracks lying within 1 mm^2 of the surface of a photo-emulsion 400 μ thick, independently of their orientation or depth. At the same time only random clusters of grains of the background are projected and this lowers general background by a factor of 1000. The speed of scanning can be brought up to about 10 cm^2 of the surface per hour. (TCO)

10848

REDUCTION OF DISTORTIONS IN EMULSION LAYERS DURING DEVELOPMENT AND FIXING. D. M. Samoylovich, Ye. S. Barinova, and Yu. G. Martynov. Pribory i Tekh. Ekspt. No. 5, 30-5(1957). (In Russian)

The swelling of nuclear emulsions under different conditions was studied and the results are given for the NIKFI-R emulsions. It was found that in favorable conditions development (including the hot stage) cannot substantially deform the emulsion and that the distortion occurs mainly during fixing and subsequent washing. Curves of swelling versus various physical parameters are given. It is shown that stripped emulsions developed without backing (such as glass) can be used for measuring mean angles due to multiple scattering of protons up to 500 Mev. (TCO)

10849

RADIO-TECHNICAL ARRANGEMENT FOR AUTOMATIC PROCESSING OF THE RESULTS OF IONIZATION MEASUREMENTS. B. N. Moiseyev and A. N. Talyzin. Pribory i Tekh. Ekspt. No. 5, 60-2(1957). (In Russian)

The outputs from gas-filled counters in a stack of four are voltage pulses whose amplitudes are proportional to the energy lost by the particles in the counter compartments. The block diagram of the arrangement for dealing with the outputs is shown. The positive pulses from the counters are fed into block A where they are converted into rectangular pulses whose duration is proportional to the amplitude of the respective counter signals. If all four rectangles are now added in block B, their sum will resemble a 4-step staircase. The lowest step will correspond to the highest input signal and the highest to the lowest. In block C the three highest steps are separated out and converted back from duration to amplitude. A final summation is carried out in block D whence the pulses may be taken to an amplitude analyzer and recorded. Circuit diagrams with values are shown for blocks A, B, C, and D. The histogram of ionization loss of μ-mesons in a cosmic shower where the particles have energies of $\approx$ 300 Mev is shown. The counters were filled with propane at a pressure of 500 mm Hg. The mean square error in the measurement of the ionizing power of a single particle does not exceed $\pm$ 12.5%. The disadvantage of this arrangement is its comparative complexity (about 30 valves) and slow action (maximum length of cycle $\approx$ 700 μsec). However, it would appear to be quite reliable. (TCO)

10850

A TOROIDAL BETA-SPECTROMETER FOR STUDYING THE CONVERSION RADIATION ACCOMPANYING ALPHA-DECAY. Ye. F. Tret'yakov, L. L. Gol'din, and G. I. Grishuk. Pribory i Tekh. Ekspt. No. 6, 22-6(1957).

An iron-less spectrometer for alpha-electron coincidences with spatial focusing of electrons is described. The instrument has a resolution of about 1% and an illumination of 7%. It can be used to study conversion lines with intensities of the order of 10^{-4} electrons per alpha decay. A special "fast-slow" coincidence scheme is used to count the number of alpha-electron coincidences. Trial experiments were made using the L_{III} conversion line from the 43.5-kev gamma line of Pu^{239} with an electron energy of 26.3 kev. The L_{II} and L_{III} conversion lines of the 100-kev gamma radiation from Pu^{239} were measured. (J.S.R.)

10851

ON THE USE OF HIGH SOURCES IN BETA-SPECTROMETERS WITH DOUBLE FOCUSSING. A. V. Zolotavin, A. M. Petrun'kin, and N. N. Khalkiopova. Pribory i Tekh. Ekspt. No. 6, 27-30 (1957).

Calculations were made to find the upper limit for the size of the source in double-focusing beta spectrometers. It was found that in beta spectrometers with magnetic fields giving accurate focusing of a wide beam lying in the plane of symmetry, it is possible to use sources 0.3 ρ_0 high, where ρ_0 is the radius of the equilibrium orbit. (J.S.R.)

10852

A DOUBLE RECTANGULAR WILSON CHAMBER FOR THE OBSERVATION OF UNSTABLE HEAVY PARTICLES. Z. Sh. Mandzhavidze and G. Ye. Chikovani. Pribory i Tekh. Ekspt. No. 6, 30-3(1957).

A description is given of a Wilson cloud chamber designed to observe hyperons and heavy mesons produced in absorbers placed both directly above the chamber and inside it. The chamber works in a magnetic field of 4500 gauss. It consists of two independent chambers with a dividing chamber between the working volumes. The working volumes and the chamber between them are in an all-metal three-section body, while the expansion device is placed in a two-section massive base. In the dividing chamber various absorbers can be placed. To remove distortions caused by convection currents, the chamber is specially thermostatted to about 1/100th of a degree centigrade. The working cycle of the chamber is fully automatic. Control measurements have shown that the curvature of μ meson tracks is in agreement with previous results. (J.S.R.)

10853

PHOTOMETERING OF TRACKS DUE TO CHARGED PARTICLES IN PHOTOGRAPHIC EMULSIONS. B. A. Voykovskiy, A. I. Galaktionov, M. I. Tret'yakova, and A. Ye. Chudakov. Pribory i Tekh. Ekspt. No. 6, 38-42 (1957).

A photometer is described which can be used to determine the density of a track in a photographic emulsion. The part of the track under investigation is made parallel to the slit of the photometer. Light which passes through the track objective and then the photometer slit is intercepted by the cathode of a photomultiplier. Depending on the density of the track, the output of the photomultiplier falls or increases as the slit is moved along parallel to the track. The voltage across the photomultiplier load is then amplified and is applied to the plates of an oscilloscope. An automatic device is in-

corporated which ensures that the track always lies within the slit. The quantity h/H (where h is the maximum density on the axis of the track and H is the background density) was measured for protons and π mesons as a function of residual range. Comparing the ranges of protons and π mesons corresponding to the same value of h/H, the ratio of the mass of the protons to that of the mesons could be calculated (for ranges of 520 to 1,100, and 3,800 to 7,000 μ for protons and π mesons, respectively). Using this method, it also is possible to determine the cross-sectional profile of each track. The area under this curve is denoted by S. The following masses were found for the τ mesons: $m_\tau = (1050 \pm 175)\ m_e$ (from h/H and the range) and $m_\tau = (985 \pm 120)\ m_e$ (from S and the range). The values for the π mesons are: $m_p/m_\pi = 6.4 \pm 0.6$ (from h/H and the range) and $m_p/m_\pi = 6.6 \pm 0.5$ (from S and the range). It is found that using the "S method" it is easier to separate singly-charged particles of different nature. A measurement of S will also yield Z for relativistic particles. (TCO)

10854

AN INSTRUMENT FOR MEASURING THE LENGTH AND NUMBER OF GAPS IN TRACKS DUE TO CHARGED PARTICLES IN PHOTOGRAPHIC EMULSIONS. B. A. Voykovskiy, A. I. Galaktionov, and M. I. Tret'yakova. Pribory i Tekh. Ekspt. No. 6, 42-5(1957).

A gapmeter is described which can be used to measure simultaneously the length of a given part of a track due to a charged particle, the number and the total length of gaps (of given length or greater than a given length) between the grains of the emulsion. Curves are given of the differential and integral gap length as functions of range for protons and π mesons in NIKFI-R emulsions. The microscope stage on which the emulsion is placed is moved by means of an electric motor. To begin with, the track under investigation is lined up parallel to the direction of motion of the microscope stage. The movement of the stage is transformed into photoelectric impulses which after amplification and shaping are fed into a counter. In one of the eye pieces of the microscope there is a thin wire perpendicular to the track. When the beginning of the part of the track under investigation coincides with the wire the observer presses a button which switches in the counter which measures the total length of the track. When the wire coincides with the beginning of a gap the observer switches in the counter which measures gap length and automatically counts the number of gaps. After each 100 μ of the track the motor automatically stops and the observer makes a note of the readings of the counters. The motor has a variable speed which can be regulated by the observer. Curves are given of gap length L as a function of range for protons and π mesons, the total length of the gaps as a function of range for π mesons, protons and τ mesons, and the total number of gaps as a function of range for π mesons, protons and τ mesons. (TCO)

10855

ON THE WORKING LIFE OF ARGON—$CH_2(OCH_3)_2$ FILLED COUNTERS OF RADIOACTIVE RADIATION. L. S. Eyg and V. G. Chaykovskiy. Pribory i Tekh. Ekspt. No. 6, 49-54(1957).

The working characteristics of self-quenching counters deteriorate with age. Results are presented of a mass spectrometric analysis of the gas mixture during the working of the counter. The counters used for the experiment were of the usual co-axial form. The tungsten anode was 0.1 mm in diameter and had a working length of 80 mm. The cathode was in the form of a layer of copper deposited on the inner wall of the glass envelope. Counters were filled with 15% (by pressure) chemically pure dimethoxymethane, and the pressure was brought up to 100 mm Hg by the addition of argon. Two groups of counters were used. The first group, consisting of 60 counters, was used to study changes in the chemical composition of the gases and the characteristics of the counter as functions of the number of counts. The second group, consisting of 70 counters, was used for both of these purposes and also for the study changes in the amplitude and the count rate as functions of the number of recorded counts. The results are tabulated. It can be seen that the threshold voltage increases by 50 to 60 v, the length of the plateau decreases by about 260 v, and the plateau slope increases from 2 to 20% after 2×10^8 counts. Mass spectrometric analysis led to the conclusion that the amount of dissociating organic molecules is proportional to the number of recorded counts. In the gas mixture of the counter, substances with mass number 16 and 28 appear. There are reasons to assume that mass 16 corresponds to oxygen. The aging of the counter is connected not only with the dissociation of the organic component, but also with changes in the surface of the cathode. The experiments have shown that with proper use argon—$CH_2(OCH_3)_2$ filled counters can be used for recording up to (1 to 2) $\times 10^8$ counts. (J.S.R.)

10856

DISCHARGE DELAY IN LOW-VOLTAGE HALOGEN COUNTERS. L. S. Eyg. Pribory i Tekh. Ekspt. No. 6, 54-7(1957).

It is usually considered that the formation of negative ions is responsible for discharge delay and the appearance of an appreciable number of spurious counts which tend to increase the plateau slope. The primary electron appearing within the volume of the counter may "stick" to an electronegative atom thus forming a negative ion. The mobility of such an ion is smaller by two or three orders than the mobility of an electron. For this reason the ion will take a much longer time to reach the filament. Near the filament, the negative ion dissociates and a free electron appears again and initiates a discharge. The duration of the delay was measured by two methods. In the first method a triple telescope was used consisting of two high-voltage counters and a low-voltage counter between them. The delay time in the high-voltage counters was estimated to be 0.1 μsec and hence one can assume that, compared with low-voltage counters, high-voltage counters have negligible delay. The high-voltage counters were connected to a coincidence circuit and the output from this circuit was used to produce the horizontal deflection of an oscilloscope. The pulse from the low-voltage counter was used to produce the vertical deflection of the oscilloscope. In this way, the delay could be determined visually. This method is not very accurate and introduces subjective errors. The second method is more accurate and is based on the measurement of double coincidences with change in the resolving time of the coincidence scheme. The pulses from a high-voltage counter were fed into one of the channels of the coincidence scheme, and the pulse from the low-voltage counter was fed into the second channel. The pulse length in the high-voltage channel could be varied between 2 and 22 μsec. At a given voltage, the number of coincidences was measured as a function of the pulse length in the high-voltage channel. As the pulse length in the high-voltage channel is increased the number of

coincidences also increases. At the pulse length comparable with the delay time of the low-voltage counter, the slope of the curve suddenly changes. It is clear that in counters having cathodes 18 mm in diameter, the delay is greater than in counters with cathodes 10 mm in diameter. This is explained by the fact that in the bigger counter the negative ion has to cover a larger distance between the moment of its formation and the moment when it loses the electron. At a nominal voltage of 400 v, low-voltage counters can be used in coincidence schemes having resolving times not less than 7 to 10 μsec. (TCO)

10857

MULTI-CHANNEL AMPLITUDE ANALYSER WITH RECORDINGS ON A POTENTIALOSCOPE. G. P. Mel'nikov, L. I. Artemenkov, and Yu. M. Golubev. Pribory i Tekh. Ekspt. No. 6, 57-67(1957).

A multi-channel analyzer utilizing the principle of amplitude-time transformation and having a dead time of 1.5 μsec per channel is described. The circuitry is given. The gamma spectra from Hg^{203}, Cs^{37}, and Co^{60} were recorded and are presented. A number of simplifications and modifications are mentioned which should make it possible to build a table-model analyzer of the oscillograph type with about 50 tubes, 100 to 300 channels with practically unlimited channel capacity, 1 to 2 μsec average dead time, and twin or linear recordings of the spectrum. (J.S.R.)

10858

USING A POTENTIALOSCOPE FOR MULTI-CHANNEL AMPLITUDE-TIME ANALYSERS. V. N. Il'inskiy and V. B. Chernyayev. Pribory i Tekh. Ekspt. No. 6, 67-8 (1957).

In multi-channel amplitude and time pulse analyzers with one common memory element for storing information on the filling of the channels, the main part of the working time is spent on regenerating the earlier recorded information by means of auxiliary radio circuits. In the present experiments a special electron-beam tube of the potentialoscope type, similar to those in computers was used for storing information. Information on the surface of the targets of such tubes is conserved for several minutes or even longer and, therefore, it becomes unnecessary to frequently regenerate the information. This permits construction of a system with a short resolution time and a large fraction of recording time for the investigated radiations; the average time for recording information is considerably shorter The first variant of such an instrument has 32 channels with an average resolution time of 40 μsec for a uniform spectrum and a capacity of 32,767 pulses per channel for a twin system of accumulating formation. The number of channels can be increased to 64 without complicating the radio circuit. The operation of the instrument is based on a quartz oscillator, which provides the three frequencies, 1 Mc, 125 kc, and 50 cps. The instrument contains 55 tubes and has a power consumption of 600 va with the power supply from a 127/220 v system. (TCO)

10859

SINGLE CABLE VARIANT OF A LINEAR AMPLIFIER WITH AN INCREASED PROTECTION AGAINST INTERFERENCE. Ye. P. Ovchinnikov. Pribory i Tekh. Ekspt. No. 6, 69-71(1957). (In Russian)

The design of a linear amplifier intended for operation with ionization chambers and proportional counters in the case of large distances between the radiation detector and the recording equipment is described. The portable part of the equipment, comprising a radiation detector, a linear amplifier, and a high-voltage rectifier, is connected with a single coaxial cable both for power supply and for transmitting the voltage impulses. The single cable variant of the linear amplifier does not require a separate source for feeding the tube filaments and is characterized by an increased protection against interference. The block schematics of the proposed equipment is given. The basic circuit diagram and the circuit diagram of the portable part is also shown. The coefficient of amplification of the portable amplifier equals 5,000 and the impulses in the connection cable have an amplitude of 0.25 to 5 v which excludes the necessity of special screening. (TCO)

10860

AN IMPROVEMENT IN THE ENERGY RESOLUTION OF THE IONIZATION CHAMBER WITH A GRID. B. A. Bochagov, G. Ye. Kocharov, and G. F. Kirshin. Pribory i Tekh. Ekspt. No. 6, 72-4(1957). (In Russian)

The main factors which have an effect on the energy resolution of an ionization chamber containing a grid are considered. As is known, the presence of even a small gas impurity such as oxygen on water vapor causes a deterioration of the energy resolution. To clean up the gas, a sodium "filter" was used. The clean-up took about 2 to 3 hours. By a suitable choice of the first valve of the amplifier, and by suitable matching, the RMS value of the noise was reduced to 6.8 kev. The signal-to-noise ratio depends on the pass band of the amplifier as well as the characteristics of the first valve. To obtain a maximum signal-to-noise ratio, it is necessary to use valves having a small grid current as well as very curved characteristics. The energy spectrum of α-particles from U^{234} and U^{238} was measured using the above circuitry. The half width of the α lines was found to be about 30 kev. (TCO)

10861

SOLID HYDROGEN TARGETS ON THE SURFACE OF PHOTOGRAPHIC EMULSIONS. V. A. Otroshchenko, V. A. Sviridov, K. D. Tolstov, and A. I. Shal'nikov. Pribory i Tekh. Ekspt. No. 6, 110-11(1957). (In Russian)

It is difficult to study interactions between elementary particles and protons and deuterons which are included in nuclear emulsions because their number is small compared with the total number of nucleons bound in the nuclei of the emulsion. This is still true even when the emulsion is specially loaded with deuterium and hydrogen. To remove this difficulty, it is convenient to have a target of solid hydrogen or deuterium deposited directly on the surface of the emulsion. To obtain sufficiently thick solid hydrogen targets on top of emulsions, a special device was used. The photoemulsion kept at the bottom of the plate-holder was surrounded by liquid hydrogen. Through a tube deuterium gas was introduced into the plate holder and slowly solidified on top of the emulsion by liquid hydrogen. After this, the Dewar containing the hydrogen was evacuated, and the plate-holder was lifted into position for irradiation by a beam from an accelerator. In the case of the solid hydrogen target, liquid helium was used as the cooling agent. (TCO)

10862

ON A SYSTEM OF SLOW EXPANSIONS FOR A WILSON CHAMBER. V. B. Yeliseyev. Pribory i Tekh. Ekspt. No. 6, 112-13(1957). (In Russian)

For reducing the "dead" time of Wilson chambers, slow expansion is applied. Usually, this consists of a slow-expansion valve and a drive insuring response of the valve at the appropriate times. A drive system is

described which uses as a switching element a standard telephone stepwise selector mechanism. In principle, this system permits realization of any desired number of slow expansions and permits blocking of the control circuit during the operating cycle of the chamber. The system is simple to produce and reliable in operation. Two relays are used for protecting the contacts of the pressure gage and of the telephone selector mechanism from excessive current intensities. (TCO)

10863

AN INSTRUMENT FOR MEASUREMENT OF ELECTRON BEAM PROFILE. Yu. V. Troitskiy. Pribory i Tekh. Eksp. No. 6, 113-14(1957). (In Russian)

The essential part of the instrument is a tantalum target upon which an electron beam is incident. The target is in the form of a step and can be moved across the beam. Two slits are cut in the target and are at different distances from the electron gun, in this case 5 and 20 mm. The length of the slits is 10 mm and their width 0.1 mm. Collectors are placed behind the slits. The target, collectors, second anode of the gun, and the screen are at the same potential. The entire device is in a continuously evacuated spherical container. The target is moved by means of a silphon bellows. Typical results obtained with this instrument are shown. The instrument is very simple in construction and does not require centering. (TCO)

10864

BUBBLE CHAMBERS. E. V. Kuznetsov. Uspekhi Fiz. Nauk 64, 361-89(1958) Feb. (In Russian).

Descriptions are given of the working principle and design of bubble chambers. The construction, the liquids used in the chamber, and the performance characteristics of the bubble chamber are described, as well as the methods for measuring the velocity of the particles. (R.V.J.)

10865

NUCLEAR REACTOR FISSION PRODUCT MONITORS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 3, Session 25. J. Kohl (Tracerlab, Inc., Richmond, Calif.). New York, American Institute of Chemical Engineers, 1958. 36p.

In the operation of a test or power reactor, it is necessary that a monitoring device be used that will detect the presence of fission products in a radioactive coolant and that will permit locating the fuel element whose rupture has released the fission product. Instruments developed for this purpose include delayed neutron monitors, ion exchange monitors, electrical precipitators, differential gamma spectrometers, Cherenkov detectors, and gaseous fission product stripping and detection systems. These systems are described, the advantages and disadvantages of each are discussed, and available operating experience is presented. (auth)

10866

APPLICATION OF PULSE HEIGHT ANALYSIS TO HEALTH PHYSICS PROBLEMS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 4, Session 12. A. B. Carlson and E. L. Geiger (E. I. du Pont de Nemours and Co., Aiken, S. C.). New York, American Institute of Chemical Engineers, 1958. 11p.

The application of pulse-height analyzers to health physics problems is discussed. These analyzers provide analytical data rapidly, often at great savings in manpower and laboratory facilities. (auth)

10867

ISSLEDOVANIYA V OBLASTI DOZIMETRII IONIZIRUYUSHCHIKH IZLUCHENIY. SBORNIK STATEY. (Investigations in the Field of Ionizing Radiation Dosimetry. Collected Articles.) K. K. Aglintsev, Ye. B. Kuznetsova, and A. B. Kiseleva, eds. Moscow, Izdatel'stvo Akademii Nauk S.S.S.R., 1957. 191p. (In Russian)

Seventeen articles dealing with investigation of absolute measurements of beta active substances, scintillation methods, individual control devices, dosimetry measurement techniques, and calculations relating to admissible level limits of exterior radiation fluxes were compiled. The papers represent studies made from 1950 to 1954. Part of the papers were submitted at the conference of dosimetry held in 1954 by the Academy of Sciences, USSR. 233 references. (J.S.R.)

Mesons

Refer also to abstract 11176.

10868 AFOSR-TN-58-446

Maryland. Univ., College Park.

ON THE RADIATIVE CORRECTIONS TO THE SCATTERING OF MESONS IN AN EXTERNAL ELECTROMAGNETIC FIELD. Technical Report No. 103. Anand K. Bhatia and Joseph Sucher. May 1958. 24p. Contract AF49(638)-24. (AD-158251).

The second order radiative corrections to the scattering of a spin-zero particle in an external electromagnetic field were calculated with the aid of the Klein-Gordon formalism. After rectification of an error in the earlier work of Kinoshita and Nambu, who used the Duffin-Kemmer formalism, the present result is in agreement with the corrected result of these authors. (auth)

10869 NP-tr-83

ELASTIC SCATTERING AND INTRINSIC STRUCTURE OF ELEMENTARY PARTICLES. D. I. Blokhintsev, V. S. Barashenkov, and V. G. Grishin. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1958. 17p. (Translation partially illegible.)

Experimental data on elastic scattering of π^- mesons on protons with energy E = 1.3 Bev have been analyzed. It is shown that from the analysis of their angular distribution it is possible to determine the root-mean-square radius and to obtain data on the distribution of matter inside the nucleon. Root-mean-square "pion radius" is found to be equal to $\sqrt{\langle r^2 \rangle} = (0.82 \pm 0.06) \times 10^{-13}$ cm. In conclusion a possible experimental criterion of the existence of elementary length is considered. (auth)

10870 NP-tr-86

ON THE ANGULAR DISTRIBUTION OF μ^+ MESONS IN THE $(\pi-\mu)$ DECAY. N. P. Bogachev, A. C. Mihul, M. G. Petrasku, and V. M. Sidorov. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1957. 7p. (Translation partially illegible)

Results from 10,000 $\pi-\mu$ decays taking place in nuclear emulsions were studied for the asymmetry coefficient. The angular distribution of the μ^+ meson gives the resulting coefficient to be 0.009 ± 0.018. (W.D.M.)

10871 NP-tr-87

ON THE INTERACTION BETWEEN K-MESONS, PIONS, NUCLEONS AND HYPERONS. V. S. Barashenkov. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1958. 5p.

The magnitude of the interaction between π or K

mesons and hyperons and between K mesons and nucleons is investigated starting from the fact that the interaction between pions and nucleons is strong. Agreement between the statistical theory of plural particle production and experiment can be attained only if weak interaction of K mesons with pions and nucleons is assumed. (W.D.M.)

10872 NP-tr-88

THE LAGRANGIAN INTERACTION AND OPERATORS OF BARYON AND MESON FIELDS. V. G. Solov'ev [Soloviev]. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1958. 6p. (Translation partially illegible.)

The properties of the wave functions of particles with spin 0, π, and K mesons, and those with spin $\frac{1}{2}$, baryons, under the operations of space inversion P, time reversal T, and the operation of charge conjugation are considered. (W.D.M.)

10873 NP-tr-94

POSSIBLE TEST OF CONSERVATION OF PARITY IN PRODUCTION OF $K^{=}$ MESONS AND HYPERONS. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1958. 4p.

The conservation of parity in the reaction $\pi + N \rightarrow \gamma + K$ (where γ is Λ or Σ hyperon) with observation of the subsequent decay $\gamma \rightarrow N + \pi$ is investigated in terms of the asymmetry of distribution of the mesons(π) emitted in the hyperon decay. (W.D.M.)

10874 NP-tr-95

EXPERIMENTAL INVESTIGATION OF THE ELASTIC AND INELASTIC INTERACTION OF π-MESONS WITH HYDROGEN IN THE ENERGY REGION 300-370 MEV. S. M. Korenchenko and V. G. Zinov. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1957. 40p. (Translation partially illegible.)

The differential cross sections for elastic and charge-exchange scattering of mesons(π^-) on hydrogen at incident energies of 307 and 333 Mev have been measured. From the obtained angular distributions it follows that the coupling constant of meson-nucleon interaction has the value 0.08 to 0.1. The differential cross sections for production of charged mesons at an angle of 80° are obtained. At 370 Mev the inelastic cross section is about 60% of the elastic cross section. (W.D.M.)

10875

PRODUCTION OF MESONS AT HIGH ENERGY. C. M. Garelli (Univ. of Turin). Energia nucleare (Milan) 5, 307-13(1958) May. (In Italian)

The production of π mesons in the collision of two nucleons at high energy is discussed. Theories regarding multiple production are illustrated, and theoretical hypotheses are compared with experimental results. (auth)

10876

HYPERONS. L. A. Rasorenov. Nauka i Zhizn No. 8, 17-19(1957). (In Russian)

A brief summary is given of the classification and structure of hyperons. (J.S.R.)

10877

PION-NUCLEON SCATTERING AND THE STRUCTURE OF THE PION. Shigeru Machida (Rikkyo Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 18, 467-82(1957) Nov.

Effects of the "structure" of the pion on the pion-nucleon scattering are discussed. A formal expression of the interaction kernel for the nucleon-antinucleon propagator is given, from which the "effective Hamiltonian" for the emission and absorption of one pion and that for two pions is derived, respectively. Effects of two-pion vertex, which is characteristic of the structure of the pion, seem to be not necessarily negligible compared with the effects of one-pion vertex, according to a very rough estimate of the order of magnitude of the "coupling constant" appearing in the interaction kernel for the nucleon-antinucleon propagator. At present two standpoints are recognized with respect to the theory of the pion, i.e., the compound theory of the pion and the conventional local pion field theory. However, some important properties of both theories are discussed by using the above method, and the qualitative properties concerning the isospin dependence of the pion-nucleon scattering matrix elements are obtained. Quantitative evaluation of the possible effects is not made, since for that purpose it is necessary to attack the details of the structure of the pion. It is shown, in the appendix, that the crossing symmetry for the pion-nucleon scattering holds even if the pion is considered to be composed of an arbitrary number of fermion pairs and bosons, provided that the primary interaction Lagrangian satisfies the integrability condition to assure the existence of propagators. (auth)

10878

SPIN AND SIZE OF Λ^0 PARTICLE. Keiichi Nishimura (Rutgers Univ., New Brunswick, N. J.). Progr. Theoret. Phys. (Kyoto) 18, 665-6(1957) Dec.

The equation of Ruderman and Karplus, $Q^{(-)} = 0.4\,(17)^{l}(E_b)^{l/2}$, which predicts a spin of $\frac{1}{2}$ and $\frac{3}{2}$ for the Λ^0 when l = 0 and 1, is analyzed for mass effects. (D.E.B.)

10879

NEGATIVE K-PARTICLE CAPTURE WITH THE EMISSION OF $_{\Lambda}He^{5}_{2}$. B. P. Bannik, D. K. Kopylova, and A. A. Nomofilov (Joint Inst. for Nuclear Studies). Soviet Phys. (Doklady) 2, 468-71(1957) Sept.-Oct.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 5588.

10880

DISPERSION RELATIONS FOR THE SCATTERING OF K-MESONS BY NUCLEONS. M. K. Polivanov (Joint Inst. for Nuclear Research). Soviet Phys. (Doklady) 2, 472-4(1957) Sept.-Oct.

The dispersion relations for the scattering of K mesons by nucleons $K + N \rightarrow K + N$ (and $\bar{K} + N \rightarrow \bar{K} + N$) are analyzed. The Hamiltonian for the scattering amplitude is derived, and the integration over the negative energies is eliminated. For an analysis of the region $0 < E < \sqrt{m^2 + p^2}$, where m and p are quantum numbers of the nucleon and meson before scattering, a representation of $A_{\alpha\omega}(E)$ is used. (J.S.R.)

10881

ON THE INTERACTIONS OF MUONS AND NUCLEONS. I. S. Shapiro, E. I. Dolinskii, and L. D. Blokhintsev (M. V. Lomonosov Moscow State Univ.). Soviet Phys. (Doklady) 2, 475-7(1957) Sept.-Oct.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 5532.

10882

NEUTRAL AND CHARGED HYPERONS. A. Battig. Univ. nacl. Tucuman Inst. fis. y mat. No. 33, Publ. No. 707, 1-65(1955). (In Spanish)

An analysis of the experimental data as well as an interpretation of the different modes of disintegration which are possible or could be possible in the case of hyperons is presented. The paucity of information on the fundamental characteristics of the hyperon such as

mass, disintegration scheme, nature and characteristics of the secondary particles, and the energy released in the disintegration is emphasized. (J.S.R.)

10883

PRODUCTION OF NEGATIVE π MESONS BY 660-Mev PROTONS ON NUCLEI OF VARIOUS ELEMENTS. A. G. Meshkovskii, Ya. Ya. Shalamov, and V. A. Shebanov. Soviet Phys. JETP 6, 463-5(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3120.

10884

ENERGY DEPENDENCE OF THE ANGULAR CORRELATION IN THE $\pi^+ - \mu^+ - e^+$ DECAY. A. O. Vaisenberg and V. A. Smirnitskii. Soviet Phys. JETP 6, 477-9 (1958) Mar.

The energy spectrum of positrons from $\pi^+ \rightarrow \mu^+ \rightarrow e^+$ decays in emulsions, and the energy dependence of the angular correlation in these decays are studied. It is shown that the coefficient A in the formula $1 + A \cos \vartheta$ for the angular correlation increases rapidly with increasing positron energy, in agreement with the two-component theory of the neutrino. (auth)

10885

LAGRANGIAN FOR THE INTERACTION OF K-MESONS AND HYPERONS. V. G. Solov'ev (Joint Inst. for Nuclear Research). Soviet Phys. JETP 6, 613-14(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3122.

10886

INTERACTION OF FERMIONS AND THE $K_{\mu 3}$-DECAY. S. G. Matinyan (Inst. of Physics, Academy of Sciences, Georgian SSR). Soviet Phys. JETP 6, 614-15(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3123.

10887

DISPERSION RELATIONS FOR S AND P WAVES FOR MESON PHOTOPRODUCTION IN FIRST ORDER OF 1/m. L. D. Solov'ev (Moscow State Univ.). Soviet Phys. JETP 6, 617-18(1958) Mar.

10888

A VARIANT OF HYPERON THEORY. Ya. B. Zel'dovich (Academy of Sciences, USSR). Soviet Phys. JETP 6, 641-2(1958) Mar.

The hyperon model representing hyperons as compound particles consisting of nucleons and $\overline{K}$ mesons, bounded together by forces dependent on the isotopic spin, is used to derive a relation connecting the masses of the nucleon N and the hyperons Λ, Σ, and Ξ. On the assumptions that the interaction between $\overline{K}$ particles is small compared with the interaction between a $\overline{K}$ and a nucleon and that in a hyperon with $S = -2$ the two $\overline{K}$ particles are in the same state as that of a single $\overline{K}$ in a hyperon with $S = -1$, the relationship $2M_\Xi + 2M_N = 3M_\Lambda + M_\Sigma$ is derived. (J.S.R.)

Meteorology

10889

A SEMI-EMPIRICAL THEORY OF TURBULENT DIFFUSION. A. S. Monin. Trudy Geofiz. Inst. Akad. Nauk S.S.S.R. No. 33, 3-47(1956).

An analysis of solutions of a parabolic equation for diffusion describing the distribution of concentration of diffusing admixtures when several admixture sources are present is given. Several methods for determining the coefficient of turbulent diffusion in the troposphere and the near-surface layer of air are examined. An analogy is drawn between turbulence and molecular diffusion, and a suitable equation for diffusion in the atmosphere, diffusion in a field of homogeneous turbulence, diffusion in the case of a near-surface layer of a non-stratified nature, diffusion in a thermally non-homogeneous near-surface of air, and the variations in velocity of the wind with altitude is discussed. (J.S.R.)

10890

ANALYSIS OF HEAT AND MOISTURE TRANSFER RELATED TO GENERAL ATMOSPHERIC CIRCULATION. Ye. Ya. Shcherbakova and A. Yu. Bregina. Trudy Glavonoy Geofiz. Observatorii No. 70, 3-37(1957).

The quantitative characteristics of the heat and moisture changes in air masses passing over the Eurasian continent are investigated. The passage takes an average of eleven days. The velocity of heat and moisture transfer is evaluated, and it is found that the velocity is greater in the north than in the south and greater in the western than in the eastern part of the continent. In meridianal types of circulation, the maximum loss (about 300 cal/cm^2 per day) occurs during the transfer of air masses from the southern parts of the Atlantic and the Mediterranean to the north. (J.S.R.)

Microwaves

10891

MEASUREMENT OF SHUNT IMPEDANCE OF A CAVITY. Kenneth B. Mallory (Stanford Univ., Calif.). J. Appl. Phys. 29, 790-3(1958) May.

The equivalent shunt impedance of a lightly coupled transmission cavity can be measured by inserting very small perturbing elements and using a simple bridge method to detect small shifts of transmission phase. A simple graphical procedure is developed for the interpretation of these measurements. It is shown that the procedure measures directly the shunt impedance R of the cavity, rather than the geometric quantity R/Q. Experimental results are presented for one such cavity, which show that phase information thus obtained is about 100 times as sensitive as amplitude information normally obtained from a transmission cavity. (auth)

Molecular Properties

10892

EFFECT OF PROTON SIZE ON THE POSITION OF ELECTRONIC LEVELS IN HYDROGEN AND DEUTERIUM. N. N. Kolesnikov (Moscow State Univ.). Soviet Phys. JETP 6, 631-3(1958) Mar.

The effect of proton size on the binding energy of the electron in hydrogen and deuterium was calculated. The distortions of the electronic wave functions was also considered. The values obtained, $\Delta E_H = 0.117 \pm 0.03$ Mc/sec for hydrogen and $\Delta E_D = 0.86$ plus $\delta_n = (\alpha/3) |\psi(0)|^2 \langle r_n^2 \rangle$ Mc/sec for deuterium, are in good agreement with experimental values. The isotopic volume effect and the mass effect is 1.33 Mc/sec + δ_n, which is in good agreement with the measurements of Lamb. (J.S.R.)

Neutrons

Refer also to abstract 11137.

10893 ANL-5846
Argonne National Lab., Lemont, Ill.
TABLES OF NEUTRON PENETRABILITIES AND SHIFT FUNCTIONS. J. E. Monahan, L. C. Biedenharn, and J. P. Schiffer. Mar. 1958. 467p. Contract W-31-109-eng-38. $6.00(OTS).

The tables give the amplitude $A_l^2(\rho)$, the penetrability $P_l(\rho)$, the shift factor $S_l(\rho)$, the phase $\phi_l(\rho)$, and the derivative $dS/d(\rho^2)$ in the case of positive energy channels for $0 \leq l \leq 6$ for values of $\rho = (2m|E|/\hbar^2)^{1/2}$ between 0 and 3 in steps of 0.001. For negative energy channels the shift factor as well as its derivative are given for the same range of l-values of $0 \leq |\rho| \leq 1$. The tables are preceded by a graphical summary illustrating the general behavior of the functions over the region covered by the computation. (W.D.M.)

10894 KAPL-1637
Knolls Atomic Power Lab., Schenectady, N. Y.
NOMOGRAMS FOR THE AREA ANALYSIS OF NEUTRON SELF-INDICATION AND TRANSMISSION MEASUREMENTS. E. L. Morgan and M. L. Yeater. Aug. 22, 1957. 51p. Contract W-31-109-Eng-52. $1.50(OTS).

An IBM-650 computer was used to calculate series terms required for the area analysis of Doppler-broadened neutron cross section resonances according to the formulation of G. M. Roe. From the resulting curves, one can derive values of peak cross section σ_0 and total level width Γ in a straightforward way. Calculations were carried out for both self-indication and flat detector cases. For the self-indication case the ratio of sample to detector thickness is varied from 0.25 to 960; this is for a range of sample thickness of 0.01 to 100 mean free paths. For the flat detector, the same range of sample thickness is covered and the nomograms are given in the same units so that they can be used interchangeably; this is particularly useful because the most sensitive determination of σ_0 and Γ is given by a combination of self-indication and flat detector measurements. A description of the formulation of the problem and the application of the results to cross section analysis are included, as well as a complete set of nomograms showing results for the cases cited. (auth)

10895 NARF-58-15T
Convair, Fort Worth, Tex.
AIR AND CONCRETE SCATTERING OF NEUTRONS. MONTE CARLO CALCULATIONS. M. B. Wells. Apr. 2, 1958. 42p. Project 6-(1-9964). Contract AF33(600)-32054. (MR-N-197).

This report supplements report FZK-9-120A.

Results from Monte Carlo calculations of the angular distribution of neutrons scattered from air and concrete are presented. The Monte Carlo method was used to evaluate the integrals that represent the contribution to the total scattered flux from the first five orders of scattering. The scattered neutron flux at various separation distances was computed for a 3.25-Mev point monodirectional source located at a height of 12.5 feet above the surface of a concrete slab. Differential scattering cross sections based on a complex square well model and differential scattering cross sections assuming isotropic scattering in the center of mass systems were used in the Monte Carlo calculations. The method used in computing the variance of the scattered flux is outlined. The standard deviation computed was found to be generally not more than 10% of the scattered flux. (auth)

10896 NP-6710
Rice Inst., Houston, Tex. and Shell Development Co., Houston, Tex.
A TABULATION OF NEUTRON ENERGIES FROM VARIOUS CHARGED PARTICLE REACTIONS. Jerry B. Marion and Betty Allen. Aug. 1955. 51p.

Neutron energies as a function of bombarding energy and angle of observation are tabulated for the ten most important reactions used as neutron sources. (D.E.B.)

10897 UCRL-1648
California. Univ., Berkeley. Radiation Lab.
RECENT TOTAL NEUTRON YIELD MEASUREMENTS. W. Crandall and G. Millburn. Jan. 21, 1951. 4p. $1.80(ph OTS); $1.80(mf OTS).

Results obtained since September 1951 by total neutron yield experiments using 190-Mev deuterons, various moderators, and the $MnSO_4$ method are summarized for uranium and thorium. (M.H.R.)

10898
THE TEMPERATURE DEPENDENCE OF THE EFFECTIVE RESONANCE INTEGRAL. L. V. Gordeyev, V. V. Orlov, and T. Kh. Sedel'nikov. Atomnaya Energiya 3, 252-5(1957).

The temperature dependence is theoretically derived, and as a result the function $\eta(\xi, 1/a)$ is graphically represented. On the ordinate the η values from 1 to 3.6 (in 0.1 steps) and on the abscissa the 1/a values from 0.1 to 1000 (in the logarithmic scale) are plotted, and the curves for $\xi = 0.04, 0.05, 0.075, 0.1, 0.15, 0.2, 0.3, 0.4, 0.5, 0.75, 1$, and 2 are drawn. (TCO)

10899
THE INTERACTION OF SLOW NEUTRONS WITH NUCLEI. V. V. Vladimirskiy, A. A. Panov, I. A. Radkevich, and V. V. Sokolovskiy. Atomnaya Energiya 3, 444-58(1957). (In Russian)

All available data on the interaction between thermal neutrons and nuclei are briefly reviewed. Particular attention is given different velocity selectors, multichannel impulse analyzers, neutron spectrometers, comparison between experimentally and theoretically determined neutron resonance level widths, and determination and comparison of the level widths of the fission resonances. (J.S.R.)

10900
SECONDARY NEUTRON SPECTRA DEVELOPING IN CONNECTION WITH NEUTRONS PASSING THROUGH LAYERS OF VARIOUS MATERIALS. Yu. S. Zamyatnin, Ye. K. Gutnikova, N. I. Ivanova, and I. N. Safina. Atomnaya Energiya 3, 540-1(1957).

The secondary neutron spectra from the reaction of 14-Mev neutrons with various elements were studied. The $T(d,n)He^4$ reaction was used as the neutron source. The energy distribution is given by $F(E) = CE\exp(-E/T)$, where C is the normalization factor and T is a parameter which is analogous to a temperature at an excitation energy E of the residual nucleus. The following values of T (in Mev) were obtained:

Isotope	T	Isotope	T
Li^6	0.78 ± 0.8	Cu^{65}	0.76 ± 0.06
Li^7	0.80 ± 0.08	Mo^{98}	0.65 ± 0.06
Be^9	0.70 ± 0.07	Cd^{112}	0.62 ± 0.05
Be^{11}	0.75 ± 0.10	Sb^{122}	0.60 ± 0.06
C^{12}	0.82 ± 0.08	W^{184}	0.62 ± 0.08
Mg^{24}	0.98 ± 0.08	Hg^{201}	0.60 ± 0.05
Al^{27}	1.13 ± 0.08	Pb^{207}	0.73 ± 0.05
Fe^{56}	0.70 ± 0.07	Bi^{209}	0.90 ± 0.08

(J.S.R.)

10901
INSTRUMENTATION FOR FAST NEUTRON TIME-OF-FLIGHT STUDIES. R. V. Smith (Westinghouse Research Labs., Pittsburgh). IRE Trans. Nuclear Sci. NS-5, No. 1, 10-12(1958) June.

In connection with a continuing program of fundamental research concerning the scattering of fast neutrons, instrumentation has been developed for measuring the energies of 1 to 4 Mev neutrons by means of their flight time over a one-meter path. Some problems involved in measuring the resultant 30 to 70 μsec time intervals with an accuracy of a few % are discussed, together with the limitations imposed by intensity considerations, presently available photomultipliers, and known electronic recording techniques. Some results are given showing the spectra of neutrons scattered from a primary energy of 4.3 Mev by zirconium, carbon, nickel, aluminum, and chromium. (auth)

10902
NEUTRON PENETRATION IN INFINITE MEDIA: CALCULATION BY SEMI-ASYMPTOTIC METHODS. Samuel S. Holland, Jr. (Technical Operations, Inc., Burlington, Mass.). J. Appl. Phys. 29, 827-33(1958) May.

Application is made of the semi-asymptotic method of Spencer to the penetration and slowing down of neutrons in infinite media. This method can handle complete numerical input data, and is not restricted in distance. Calculations are carried out for the ideal constant cross section case, and a 1-kev point source in air. Complete flux spectra for the 1-kev point source are given for distances out to 100 mean free paths (mfp). (auth)

10903
TOTAL CROSS SECTIONS FOR FAST NEUTRONS BY A TIME OF FLIGHT METHOD. P. Huijer, C. C. Jonker, J. Van Den Berg, and J. Rethmeier (Vrije Universiteit, Amsterdam). Physica 24, 331-42(1958) May.

A time-of-flight method for the determination of total cross sections for fast neutrons was realized by detecting neutrons twice along their path by stilbene scintillation counters. The time interval between the pulses of the two counters is measured by a delayed coincidence circuit and determines the energy of the neutrons between the counters. The experimental arrangement and its properties with respect to efficiency, energy resolution and background are discussed. The time resolution was limited by the low efficiency of the coincidence circuit for resolving times smaller than 4×10^{-9} seconds. The method was tested by measuring with an average energy resolution of 20% the total cross section of sulfur between 400 and 1200 kev. The results are compared to earlier measurements and to the optical model. Further possibilities of the method are discussed. (auth)

10904
NEUTRON YIELDS FROM Rn + B, Rn + C, Rn + CaF_2, Rn + Mg, Rn + Al, Rn + Si, Rn + SiO_2, Rn + GRANITE. G. V. Gorshkov and V. I. Matvienko (V. G. Khlopin Radium Inst., Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 435-6(1957) Sept.-Oct.

It is known that when light elements are irradiated with alpha particles from naturally radioactive substances neutrons are produced. Results are presented of an investigation of yields and other parameters of radon sources of neutrons. The results are tabulated for target materials of boron, carbon, calcium fluoride, magnesium, aluminum, silicon, silicon dioxide, and granite. (J.S.R.)

Nuclear Physics

10905 AECU-3690
Ohio State Univ. Research Foundation, Columbus.
STOPPING CROSS SECTIONS. Annual Report for the period March 16, 1957—March 15, 1958. (Report No. 8). James C. Harris. Mar. 28, 1958. 19p. RF Project 440. Contract AT(11-1)-147. $3.30(ph OTS); $2.40 (mf OTS).

Molecular stopping cross sections are reported for protons in bromine, chlorine, lead chloride, thallium chloride, and zinc phosphide. A description is given of a small, differentially pumped, gas scattering chamber designed for use with the Van de Graaff machine. The floor plan of the new Van de Graaff building under construction is included. (D.E.B.)

10906 HW-54591
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
NUCLEAR PHYSICS RESEARCH QUARTERLY REPORT [FOR] OCTOBER, NOVEMBER, DECEMBER 1957. Mar. 5, 1958. 85p. Contract W-31-109-Eng-52. $2.25(OTS).

Installation and calibration of the fast neutron time-of-flight spectrometer were completed. Channel width uniformity and stability, data storage, and detector design are discussed. Neutron spectra obtained from the $Be^9(d,n)B^{10}$ reaction were in agreement with energy level data. Time resolution of two millimicroseconds was obtained. Experimental results are plotted which show the variation in the ratio of the ternary to total fission cross sections of U^{235} with incident neutron energy. The results indicate the ratio is constant in the energy range 0.04 to 0.40 ev to a precision of 1%, and constant in the range 0.04 to 8.7 ev to a precision of 3 to 6%. A multichannel formula was developed for the analysis of fission cross sections where the compound nucleus formed has a few fission channels and many gamma decay channels open. Exponential pile measurements of material buckling were carried out with several different fuel elements and graphite-to-uranium ratios. Results obtained in cases with air coolant are correlated with theory. A theoretical attempt was made to explain the observed change in excess k in the Physical Constants Testing Reactor with the addition of buffer rods; the buffers being considered as line sources. Buckling measurements were made on random arrays of water moderated fuel elements to compare their buckling characteristics with uniform distributions. Material bucklings of graphite lattices with a solid 1.66 in. natural uranium rod were measured as a function of lattice spacing in air, water, and biphenyl. Results are tabulated. Measurements of the infinite multiplication constant for homogeneous mixtures of water and UO_3 with several enrichments were extended to include hydrogen-to-uranium ratios of about four. These and previous measurements are plotted as a function of H/U, with enrichment as a parameter. The reflector savings of uranyl nitrate solutions of various uranium concentrations were determined relative to light water. Uranyl nitrate reflected, H_2O moderated, rhomboid lattice assemblies were used. Stainless steel was used as a lattice container, and its effect on reflector savings was evaluated. The results are presented, and the experiments are described and discussed. Theoretical values of the ratio of fast to thermal fission were calculated for a number of rod sizes between 0.96 and 3.88 in. and compared with experimental values. Both theo-

retical and experimental determinations are discussed. A study was made of the reactivity of a spherical core surrounded by a reflector which can not be made critical by itself. Plots of extrapolation length versus core material buckling and critical mass versus core material buckling are given. The effects of water density on the criticality of slightly enriched homogeneous systems were determined. Calculated critical parameters, with and without the density correction, are given for 4.9, 3.0, and 1.5% enriched U^{235} systems. (For preceding period see HW-53492.) (D.E.B.)

10907 NP-6719

Naval Research Lab., Washington, D. C.

NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period January–March 1958. Apr. 1, 1958. 41p.

An electrostatic analyzer with a radius of curvature of 2 meters and a deflection angle of 90° was used to determine the bombarding energies of several (p,γ) resonances and (p,n) thresholds in the energy range from 300 kev to slightly over 3 Mev. The gamma-ray threshold technique was applied to the $O^{18}(d,n\gamma)F^{19}$ reaction in the excitation region 6.0 to 7.5 Mev. A discussion of charge conjugation, isotopic spin, and the group space of the proper Lorentz group is included. Monte Carlo calculations on finite lead slabs of 3, 6, 9, 12, 15, and 18 mean-free-paths thickness were completed for three gamma-ray energies (6.13, 2.5, and 1.0 Mev) each incident at six different angles (0, 22, 33, 44, 55, and 66°). Radiation effects on poly-α-methyl-styrene were studied because it predominantly undergoes chain scission upon exposure and at the same time has a phenyl group in its structure which offers resonant stabilization. (For preceding period see NP-6569.) (M.H.R.)

10908 PR-P-37

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PHYSICS DIVISION PROGRESS REPORT [FOR] JANUARY 1, 1958 TO MARCH 31, 1958. 71p. (AECL-587). $1.50(AECL).

Additional studies were made of the effect of time reversal on neutron beta decay using iron polarizers. Calculations by R. L. Sears indicate the $He^3(\alpha,\gamma)Be^7$ reaction now predominates in the central regions of the sun. Possible decay modes for the Be^7 under solar conditions are discussed. A method for standardizing S^{35} is described. The method is based on a comparison of $LiS^{35}O_4-NbCl_3$ and $LiSO_4-Nb^{95}Cl_3$ solutions. A spray technique was used to prepare very thin, uniform sources of Na^{22}, Na^{24}, and Co^{60}. The measured efficiency of a 4 $\pi\beta$ counter-source combination using these sources is reported. Methods used in calibrating the energy sensitivity of a 5-in. thick by 7-in. diameter plastic scintillator to be used in 14-Mev neutron scattering studies are described. Thermal neutron flux and cadmium ratio distribution measurements were made in two longitudinal and two transverse holes of NRU. Non-isotropic neutron angular distributions from U^{236} and Cf^{252} are reported. The properties of the energy levels in O^{18} from the $C^{14}(\alpha,\gamma)$ reaction are discussed. The linear polarization of 1.64 Mev gamma rays from the $C^{12}(He^3,p\gamma)N^{14}$ reaction and the 0.94 and 1.08 Mev gamma rays from the $O^{16}(He^3,p\gamma)F^{18}$ reaction was studied using 2.0 and 2.96 Mev He^3 ions. An analysis was made of the gamma ray coincidence spectra from the reaction $Be^9(He^3,p\gamma)B^{11}$. Pronounced resonance structure was observed in the excitation curves for the proton groups to the F^{18} states and for the alpha group to the ground state of O^{15} in $O^{16}(He^3)$ reactions. A search for non-resonant alpha capture in N^{14} was made in an effort to explain discrepancies in the calculated and observed angular distributions of the 2.54 Mev gamma rays. A further measurement of the change in energy of neutrons scattered from liquid helium gave $Q = 0.86\ A^{-1}$ and E = 13.1°K. A list of gamma rays energies and intensities from neutron capture in Y^{89} was prepared. The gamma spectrum from $U^{238}(n,\gamma)U^{239}$ was investigated between 0.14 and 7.6 Mev. Observed emissions are reported. Additional gamma energies observed in (n,γ) reactions with Ti^{49} are listed; intensities are given relative to the 1.378 Mev emission previously reported. Gamma-gamma correlation measurements made on the 6.41 – 0.34 and 0.34 – 1.38 Mev cascades following neutron capture in Ti confirm the ($^1/_2$-) assignment to the 1.72 Mev level in Ti^{49}. Turbulence in NRU heavy water, causing the control rods to swing about their vertical position, was found to produce an 8 Mw power fluctuation at 200 Mw levels. Shrouds were placed around the rods to protect them from the turbulence. Short notes are included on a number of radiation detection instruments being developed for reactor instrumentation. (For preceding period see PR-P-36.) (D.E.B.)

10909 NP-tr-92

THE INFLUENCE OF INTRANUCLEAR MOTION ON NUCLEUS-PARTICLE INTERACTION. V. M. Maltsev. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1958. 4p.

10910 NP-tr-93

TIME REVERSAL AND POLARISATION PHENOMENA IN REACTIONS WITH γ-RAYS. L. I. Lapidus. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1957. 21p. (Translation partially illegible.)

Polarization phenomena in the photoproduction and radiative capture of pions as well as in the Compton effect on nucleons are considered. The consequences of the invariance under time reversal are obtained. The Wolfenstein theorems are generalized for the case of reactions with γ rays. (auth)

10911

INTERACTION OF 9-Bev PROTONS WITH NUCLEI IN EMULSIONS. N. P. Bogachev, Van Shu-Fen, et al. Atomnaya Energiya 4, 281-4(1958) Mar. (In Russian)

The analysis of nuclear interactions of protons in photoemulsion showed that the mean proton path at 1 to 9 Bev varies very little. The mean path of a 9-Bev proton was found to equal 34.7 ± 1.5 cm; the mean number of fast particles formed in single interactions was 3.4 ± 0.1. The angular distribution of fast particles in laboratory coordinates and the distribution of the stars produced are shown graphically. From an analysis of 249 stars, eighteen were considered as cases of interactions with free or quasi-free protons. Thirteen stars were considered as proton interactions with quasi-free neutrons. The mean number of fast particles in such stars was 3.1 ± 0.3. The tracks of all fast particles were examined until they left the emulsion or underwent a second collision. Ten secondary stars were found. The mean path for the secondary particles was 19 ± 6 cm. (R.V.J.)

10912

ON A CONDITION FOR SUPERFLUIDITY IN THE THEORY OF NUCLEAR MATTER. N. N. Bogolubov. Doklady Akad. Nauk S.S.S.R. 119, 52-5(1958) Mar. 1. (In Russian)

A Hamiltonian is developed which describes a model

dynamic system in application to the theory of nuclear matter. (R.V.J.)

10913

THE INFLUENCE OF CONSTANT ELECTRIC AND MAGNETIC FIELDS ON THE SPIN OF THE PARTICLE. S. Sarkar (Indian Association for the Cultivation of Science, Calcutta). Indian J. Phys. 32, 124-7(1958) Mar.

If it is assumed that the particle obeys the second order equation obtained in the usual way of operating twice on Dirac's linear Hamiltonian, it is found that the change of momentum and spin direction of a particle subjected to magnetic and electric fields is the same as for a particle obeying Dirac's first order equation. (auth)

10914

PAIRING ENERGY OF NUCLEAR PARTICLES. Morikazu Nomoto (Niigata Univ., Japan). Progr. Theoret. Phys. (Kyoto) 18, 483-92(1957) Nov.

From the nuclear binding energies given by Wapstra, the pairing energies of identical nucleons have been computed and found to be expressed in the form $(22.3 \pm 5.5)(2j + 1)/A$ Mev for the even-even nuclei with mass number A, and pairs in a definite j-shell. By using the computed values of the pairing energy for the even-even and odd-A nuclei and assuming the zero range force, the inter-nucleon potential is found to be $V_{ij} = -570r_0^3[1 + (0.16 \pm 0.15)\sigma_i \cdot \sigma_j]\delta(r_i - r_j)$ Mev, where r_0 is the nucleon radius. (auth)

10915

PHOTODISINTEGRATION OF THE DEUTERON NEAR 11 Mev. Shih-Hui Hsieh (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto) 18, 637-48(1957) Dec.

It is shown that the photodisintegration of the deuteron near 11 Mev is consistent with nucleon-nucleon scattering at the corresponding energy. Some features of nuclear forces are elucidated. It is shown that the phase shift of the singlet even state is somewhat smaller than that previously supposed, and the phase shifts of the triplet odd state are not small at such an energy. (auth)

10916

THE UTILITY OF THE "INDIVIDUAL Γ_5 TRANSFORMATION." Kanji Fujii and Kenzō Iwata (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto) 18, 666-8(1957) Dec.

Assuming all interactions are invariant under the individual Γ_5 transformation, a model is discussed in which parity conservation is necessarily violated in all weak interactions. Although the predictions of this model differ substantially from those of the two component neutrino theory, the predictions of both fit available experimental data equally well. (D.E.B.)

10917

THEORY OF NUCLEAR FISSION. B. T. Geilikman. Soviet J. Atomic Energy (English Translation) Suppl. No. 1, 5-20(1957).

A survey is presented on the theory of nuclear fission. In the first section calculations of the fission barrier are reviewed. The second section considers fission probability. Qualitative considerations concerning the fission process are presented in the third section. The fourth section is devoted to work on the mass, charge, and angular distributions of fission fragments. 76 references. (J.S.R.)

10918

CROSS SECTION FOR FISSION INDUCED BY FAST NEUTRONS. Yu. S. Zamyatnin. Soviet J. Atomic Energy (English Translation) Suppl. No. 1, 21-4(1957).

In terms of the function $\sigma_f(E)$, it is possible to divide fissile isotopes into two broad groups: isotopes which fission upon thermal neutron capture, and isotopes which have a fission threshold. The first group includes the "active" materials, such as Pu^{239}, U^{235}, and U^{233}, and the experimental data at present indicate that the fission cross sections in active materials depend only weakly on neutron energy. The dependence of the fission cross section on neutron energy for nuclei in the second group is characterized by the existence of a fission threshold E_0, the magnitude of which is determined by the relation $E_0 = E_f - E_n$, where E_f is the height of the fission barrier for the intermediate nucleus and E_n is the neutron binding energy in the intermediate nucleus. Close to threshold the cross section increases almost exponentially. After reaching the threshold energy the cross section becomes a fixed quantity σ_{f0}. At neutron energies above 6 Mev there occurs a new increase in the cross section associated with the energetically possible fission which follows preliminary evaporation of a neutron by the intermediate nucleus. The values of f_0, the fission probability, and the relative cross sections for photofission were tabulated and graphed for isotopes of Th, Pa, U, Np, and Pu. It is shown that the value of f_0 for all isotopes of uranium is given by a single curve which increases with increasing Z^2/A and is independent of the parity of the nucleons in the nucleus. The values of f_0 for isotopes of the other elements are only poorly given by the uranium curve, and it would seem that there is a displacement of the curves which correspond to different Z. It is shown that unknown cross sections in the region above 7 Mev can be estimated if the fission cross sections for these isotopes are known in the energy region 2 to 5 Mev. (J.S.R.)

10919

MASS AND CHARGE DISTRIBUTION OF FISSION PRODUCTS. A. N. Murin. Soviet J. Atomic Energy (English Translation) Suppl. No. 1, 25-37(1957).

A survey of fission research, in particular of problems related to mass and charge distributions of the fragment yields, is presented. 45 references. (J.S.R.)

10920

THEORY OF FISSION OF HEAVY NUCLEI CLOSE TO THRESHOLD. V. G. Nosov. Soviet J. Atomic Energy (English Translation) Suppl. No. 1, 38-41(1957).

The experimentally observed fission asymmetry was analyzed on the basis of a spherical shape of the nucleus and an ellipsoid of rotation. The energy dependence of the fission width is discussed, and it is shown that the energy behavior of the fission width close to threshold is nonmonotonic. 10 references. (J.S.R.)

10921

ANISOTROPY IN FISSION PROCESSES. I. M. Frank. Soviet J. Atomic Energy (English Translation) Suppl. No. 1, 42-50(1957).

The problems connected with the asymmetries in the mass distribution of the fragments and the angular anisotropy in the emission of fragments in fission induced by particles of low and intermediate energy are discussed. The theoretical work being done to solve these problems is reviewed. 31 references. (J.S.R.)

10922

NEUTRON FISSION. B. G. Erozolimsky. Soviet J. Atomic Energy (English Translation) Suppl. No. 1, 51-65(1957).

A brief survey is given of the experimental data concerning the properties of fission neutrons and also an approach to a theoretical interpretation of these data. 34 references. (J.S.R.)

10923

CERTAIN FEATURES OF SPONTANEOUS FISSION IN HEAVY NUCLEI. V. N. Mekhedov. Soviet J. Atomic Energy (English Translation) Suppl. No. 1, 120-4(1957).

The relationship between spontaneous fission and α decay is discussed. A graph of the spontaneous fission half life against the α decay half life for a number of heavy nuclei reveals that for a definite range of spontaneous fission probabilities there corresponds a definite range of values for α decay. It is shown that the value of the ratio of the spontaneous fission half life to the α decay half life in nuclei with the same number of neutrons is a constant. It is also shown that, just as in α decay, where an increase of the atomic number of two units in nuclei with the same neutron number tends to reduce the half life, on the average by four orders of magnitude, an increase in the proton number in the nucleus of two or four units leads to a reduction in the spontaneous fission half life by approximately four or eight orders of magnitude. 15 references. (J.S.R.)

10924

CROSS SECTION FOR FISSION OF URANIUM BY HIGH-ENERGY PROTONS AND AN ANALYSIS OF THE LIGHT CHARGED PARTICLES CHARACTERISTIC OF FISSION. N. S. Ivanova. Soviet J. Atomic Energy (English Translation) Suppl. No. 1, 76-84(1957).

The cross section for the fission of uranium by high-energy protons was studied by exposing thick-layered photographic plates with uranium in the emulsion to 140, 350, 460, and 660-Mev protons. The results are tabulated. An analysis was made of the light charged particles found in the fission of uranium nuclei by high-energy protons. The data which characterize uranium fission by 140-Mev protons were compared to the data characterizing uranium fission by slow negative pions. 26 references. (J.S.R.)

10925

DETERMINATION OF THE THRESHOLD FOR EMISSIVE FISSION USING THICK-LAYERED PHOTOGRAPHIC EMULSIONS. V. P. Shamov. Soviet J. Atomic Energy (English Translation) Suppl. No. 1, 85-100(1957).

A description is given of an experimental determination of the initial excitation energy required to bring the original nucleus, by emission of neutrons, to the state in which fission can compete successfully with disintegration. Emulsions saturated with aqueous solutions of uranium and bismuth salts were irradiated with 660-Mev protons. Equations which relate the initial excitation energy with the number of charged particles emitted in fission were derived. An analysis was made of the charged particles associated with the fission site. A scheme is given for the determination of the thresholds for emissive fission. 16 references. (J.S.R.)

10926

SPONTANEOUS FISSION IN HEAVY NUCLEI. K. A. Petrzhak. Soviet J. Atomic Energy (English Translation) Suppl. No. 1, 101-19(1957).

The results of all the basic experimental and theoretical work which was concerned with problems involving spontaneous fission in heavy nuclei are summarized. 66 references. (J.S.R.)

10927

CERTAIN FEATURES OF NUCLEAR FISSION AT LOW AND HIGH EXCITATION ENERGIES. N. A. Perfilov. Soviet J. Atomic Energy (English Translation) Suppl. No. 1, 66-75(1957).

The new data concerning the number of fragments emitted in fission induced by fast and slow particles and the angular distribution of fission products are examined. As the fission process depends on the excitation energy of the fissioning nucleus, fission reactions at low and high excitation energies are considered separately. 39 references. (J.S.R.)

10928

PHOTOFISSION. L. E. Lazareva and N. V. Nikitina. Soviet J. Atomic Energy (English Translation) Suppl. No. 1, 125-40(1957).

A survey is made of the presently available experimental data on photofission. The problems discussed include fission cross sections and probabilities for photofission, photofission for gamma energies above 100 Mev, mass distribution of photofission fragments, and angular distribution of fission fragments. 46 references. (J.S.R.)

10929

ON THE THEORY OF THE DECAY OF A QUASI-STATIONARY STATE. L. A. Khalfin (All-Union Research Inst. of Exploratory Geophysics). Soviet Phys. (Doklady) 2, 340-4(1957) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 460.

10930

DISPERSION RELATIONS FOR WEAK INTERACTIONS. N. N. Bogolyubov, S. M. Bilen'kii, and A. A. Logunov (Joint Inst. for Nuclear Studies). Soviet Phys. (Doklady) 2, 384-6(1957) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 1585.

10931

MATRIX ALGEBRA OF THE THEORY OF SPIN $^3/_2$ PARTICLES. E. E. Fradkin (A. I. Herzen Leningrad State Pedagogical Inst.). Soviet Phys. (Doklady) 2, 399-402(1957) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 1586.

10932

PHOTODISINTEGRATION OF DEUTERON AT ENERGIES FROM 50 TO 150 Mev. Yu. A. Aleksandrov, N. B. Delone, L. I. Slovokhotov, G. A. Sokol, and L. N. Shtarkov (P. N. Lebedev Physics Inst., Academy of Sciences, USSR). Soviet Phys. JETP 6, 472-6(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3158.

10933

THE OPTICAL MODEL OF THE NUCLEUS AND THE SHELL MODEL. P. E. Nemirovskii. Soviet Phys. JETP 6, 573-6(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3187.

10934

ON THE THEORY OF THE NEUTRINO WITH ORIENTED SPIN. A. A. Sokolov (Moscow State Univ.). Soviet Phys. JETP 6, 611-12(1958) Mar.

The hypothesis of the nonconservation of parity under spatial inversion in weak interactions led to a theory of the neutrino in which the spin is always parallel to the direction of its momentum and the spin of the antineutrino is always antiparallel to its momentum. It is shown that this new theory of the neutrino can be obtained from the Dirac theory if, in the Dirac theory, one

carries out an explicit resolution of the functions in terms of spin states. (J.S.R.)

10935

ELEMENTARY NUCLEAR PHYSICS. NUCLEAR ENGINEERING MONOGRAPHS. W. K. Mansfield. London, Temple Press Limited, 1958. 67p.

This new series of monographs on nuclear engineering subjects is intended for university and technical college students, research assistants, and qualified technicians who require a broad understanding of those topics of nuclear engineering outside their own field of study. They provide a broad treatment ranging from elementary principles to up-to-date summaries of more advanced theories. This monograph, the first in the series, considers the atomic theory of matter, the nucleus, radioactivity, neutron physics, interaction of nuclear radiation with matter, and detection of nuclear radiations. (W.D.M.)

Nuclear Properties

10936 AERE-R/M-167

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

MEASUREMENTS ON Pu^{240} IN THE ZEPHYR FAST REACTOR. J. E. Sanders. Mar. 1958. 12p.

Measurements of the fission and perturbation cross sections of Pu^{240} at the center of the core of Zephyr are described, and a value for the number of neutrons per fission is derived. (auth)

10937 CWR-400-6

Curtiss-Wright Corp. Research Div., Quehanna, Penna.

ENERGY DISTRIBUTIONS OF FAST NEUTRONS INELASTICALLY SCATTERED FROM ALUMINUM. C. E. Mandeville. Dec. 1957. 43p. $7.80(ph OTS); $3.30 (mf OTS).

The energy distribution of fast neutrons elastically and inelastically scattered from Al^{27} was calculated. (T.R.H.)

10938 NDA-086-2

Nuclear Development Corp. of America, White Plains, N. Y.

AN INTERIM REPORT ON THE NEUTRON CROSS SECTIONS OF OXYGEN. H. Lustig, H. Goldstein, and M. H. Kalos. Jan. 31, 1958. 31p. For [Oak Ridge National Lab. Contract W-7405-eng-26], Subcontract 1069. $4.80(ph OTS); $2.70(mf OTS).

Values of the significant neutron cross sections for O^{16} are presented at energies up to 18 Mev. The cross sections tabulated include: total, elastic, inelastic, nonelastic, (n,α), and (n,p). The angular distribution of elastically scattered neutrons is described in terms of an expansion in Legendre polynomials and the first six expansion coefficients are tabulated from 230 kev to 18 Mev. Some of the neutron reactions in O^{17} and O^{18} which are of interest in nuclear reactors are also described. Below a neutron energy of 3 Mev the available theoretical and experimental information is sufficiently detailed and accurate that the cross sections presented here satisfy foreseeable reactor and shielding needs. Greater uncertainties surround some of the data above 3 Mev, particularly the angular distribution in elastic scattering, and further work will be needed before definitive numbers can be given in this region. (auth)

10939 NP-6762

Paris. Université.

ÉTAT ACTUEL DE NOS CONNAISSANCES FUR LA CAPTURE L. (Present State of Knowledge About L Capture.) Exposé no 8. P. Radvanyi and M. Langevin. Feb. 5, 1957. 12p.

A review is given of the experimental and theoretical work done on L capture. The three problems most studied in relation to L capture are the continuous gamma radiation accompanying the capture, the variation of the period of Be^7, and measurement of the capture ratio L/K. The experimental and theoretical determination of the ratio λ_L/λ_K is discussed in detail. (J.S.R.)

10940 NP-6768

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

AN EXPERIMENT ON NONADIABATIC PASSAGE IN NUCLEAR MAGNETIC RESONANCE. Report No. 5/11. T. Waluga, G. Zapalski, and A. Z. Hrynkiewicz. Dec. 1957. 9p.

The method of nuclear resonance in flowing liquid was used to demonstrate nonadiabatic passage. Magnetic fields of various amplitudes directed at different angles were suddenly superimposed upon the magnetic field determining the initial direction of magnetization. The results obtained are a simple confirmation of the vector model of non-adiabatic passage and constitute a good illustration of this process. (auth)

10941 NYO-6633

Carnegie Inst. of Tech., Pittsburgh.

LONG-LIVED ALUMINUM-26 (thesis). Robert A. Rightmire. June 3, 1957. 166p. Contract AT(30-1)-844. $4.25(OTS).

Theoretical and experimental evidence has indicated a level in Al^{26} below the 6 sec 0^+ level. The ground state lies 4.01 ± 0.02 Mev above that of Mg^{26}, has a 5^+ configuration, and evidently is very long-lived. Al^{26} and Na^{22} are produced simultaneously by deuteron and proton bombardment of magnesium targets. Chemical procedures for isolating each nuclide in carrier-free and radiochemically pure state were developed. The maximum positron energy of the long-lived ground state of Al^{26} was determined to be 1.16 ± 0.02 Mev. The scintillation gamma spectrum shows four full-energy peaks. The most intense, at 0.51 Mev, is due to positron annihilation. A strong peak at 1.83 Mev and two weak peaks at 1.14 and 2.97 Mev correspond to transitions from the known Mg^{26} first and second excited states. The relative intensities of the annihilation and gamma radiations indicate that Al^{26} undergoes 85.5 ± 1.8% positron emission to the 1.83 Mev state of Mg^{26}; 11.5 ± 1.9% electron capture to the same state; 3.7 ± 0.3% electron capture to the 2.97 Mev state followed by emission of 1.14 and 1.83 Mev gamma rays; 0.30 ± 0.06% electron capture to the same state followed by 2.97 Mev radiation. The resulting disintegration scheme is shown. Thick target bombardment yields of natural magnesium with 15-Mev deuterons were determined to be: Al^{26}, (1.4 ± 0.13) dis/min/μah; Na^{22}, (4.6 ± 0.3) × 10^6 dis/min/μah. Yields using 20.8 Mev protons gave: Al^{26}, (3.5 ± 0.4) dis/min/μah; Na^{22}, (1.92 ± 0.19) × 10^5 dis/min/μah. A total of 2300 ± 300 dis/min of Al^{26} was isolated from an aluminum sheet exposed to 8 × 10^{20} neutrons/cm^2 in a reactor. The half-life of Al^{26} was estimated at 1 × 10^6 yrs from the ratio of Al^{26} activity to Na^{22} activity. A determination of the half-life by the specific activity method yielded a preliminary result of (6 ± 3) × 10^5 years. (W.D.M.)

10942 UCRL-3887

California. Univ., Berkeley. Radiation Lab.

ANGULAR DISTRIBUTIONS FOR (p,p'), (p,d), AND (α,α') REACTIONS IN LITHIUM-7 AT MEDIUM ENERGIES (thesis). Robert Silver. Aug. 2, 1957. 51p. Contract W-7405-eng-48. $9.30(ph OTS); $3.60(mf OTS).

A natural lithium target was bombarded by 31.8-Mev protons and the energy spectrum of the emitted particles taken every 10° from 10 to 120° and at 140 and 160°. Proton peaks corresponding to the ground state and to the 4.61-, 6.6-, and 9.6-Mev levels of Li^7 were observed. Angular distributions for the 4.61- and 6.6-Mev levels of Li^7 were obtained and fitted with the direct-interaction theory of Austern, Butler, and McManus. (Deuterons from the Li^6 ground state, 2.19-, and 3.57-Mev levels have also been identified.) The ground-state and 2.19-Mev deuteron angular distributions were fitted with the Butler pickup theory. In addition, lithium was bombarded with 47.1-Mev alpha particles and an angular distribution obtained for the inelastically scattered alpha particles leaving Li^7 in the 4.61-Mev state. This distribution was also fitted with the direct-interaction theory. Possible spins and parities were assigned the levels for which angular distributions were obtained. (auth)

10943 UCRL-5230

California. Univ., Livermore. Radiation Lab.

NEUTRON NONELASTIC CROSS-SECTION MEASUREMENTS FROM 7 TO 29 MEV. Malcolm H. MacGregor. May 19, 1958. 7p. Contract W-7405-eng-48. $1.80 (ph OTS); $1.80(mf OTS).

Neutron nonelastic cross sections have been measured for 23 elements at 14 Mev, and for a selected set of these elements over the energy ranges 7 to 14 Mev and 21 to 29 Mev. Conventional sphere transmission techniques were used for the measurements. A comparison with optical model calculations of Bjorklund and Fernbach shows excellent agreement. (auth)

10944 UK/C/6/124

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

RELATIVE VALUES OF THERMAL NEUTRON FISSION CROSS-SECTIONS. [Paper Presented at] Sixth UK/Canada Technical Conference, Chalk River, Ontario, October 21-22, 1957. C. B. Bigham, G. C. Hanna, H. Lounsbury, and P. R. Tunnicliffe. Sept. 1957. 6p.

Paper presented at International Conference, Columbia Univ., N. Y. Sept. 9-13, 1957.

Fission cross section ratios are reported, using Maxwellian neutron spectra, for U^{233}/U^{235}, Pu^{239}/U^{235}, Pu^{239}/U^{233}, and Pu^{241}/Pu^{239}. The measured values are 0.9323, 1.4056, 1.5048, and 1.551, respectively. (D.E.B.)

10945

NUCLEAR ENERGY LEVELS OF Tm^{169}. S. A. Baranov, R. M. Polevoy, Yu. F. Rodionov, and G. V. Shishkin. Atomnaya Energiya 3, 256-7(1957).

By means of a double-focusing β spectrometer, a scintillation spectrometer, and a proportional aiming tube the γ radiation of the nucleus Yb^{169} was measured, and a random scheme was set up. The following γ energies with the corresponding multipole order was found:

8.42 (M1 + E2)	130.48 (E2)
20.74 (M1)	156 ?
63.13 (E1)	177.21 (0.75 M1 + 0.25 E2)
93.62 (0.9 M1 + 0.1 E2)	197.97 (M1)
109.67 (M1)	240.6 (E1 ?)
118.20 (E2)	260.8 (E1 ?)
	307.7 (E2)

The following level values (with spin and parity in brackets) were calculated:

0	($\frac{1}{2}$)
8.42	($\frac{3}{2}$ ±)
118.20	($\frac{5}{2}$ ±)
138.90	($\frac{7}{2}$ ±)
316.06	($\frac{7}{2}$ ±)
379.19	($\frac{7}{2}$ ±)
472.8	($\frac{9}{2}$ ±)

(TCO)

10946

THE ANGULAR DISTRIBUTION OF ELASTICALLY AND INELASTICALLY SCATTERED 2.9 Mev NEUTRONS. V. I. Popov. Atomnaya Energiya 3, 498-506 (1957).

The angular distribution and the scattering cross section for iron, copper, lead, and bismuth were measured for 2.9-Mev neutrons with an ionization chamber filled with hydrogen and of a spherical geometry. The results are tabulated. (J.S.R.)

10947

MEASUREMENT OF NEUTRON RESONANCE ABSORPTION INTEGRALS. V. B. Klimentov and V. M. Gryazev. Atomnaya Energiya 3, 507-14(1957).

The neutron resonance absorption integral was measured for a number of elements using the statistical method of the reactivity modification of the reactor. The following results were obtained with the neutron resonance absorption integral being given in barns:

Element	Resonance Integral	Element	Resonance Integral	Element	Resonance Integral
B	280 ± 40	Ga	11.7 ± 2.7	Cs	169 ± 23
N	4.8 ± 2.4	Ge	3.5 ± 2.9	Ba	12.6 ± 1.7
F	2.3 ± 0.5	Sc	9.6 ± 1.25	Sm	1790 ± 270
Cl	12.8 ± 1.7	Br	118 ± 14	Gd	67 ± 8
K	3.5 ± 1.7	Rb	9.0 ± 2.8	Hf	1470 ± 200
Ti	3.8 ± 0.9	Sr	10.0 ± 2.6	Ta	474 ± 62
V	3.3 ± 0.8	Zr	3.7 ± 0.5	W	290 ± 35
Cr	2.6 ± 1.1	Mo	13.8 ± 1.7	Os	180 ± 20
Mn	11.7 ± 1.5	Ag	466 ± 70	Ir	2000 ± 490
Fe	2.3 ± 0.4	In	2220 ± 300	Hg	72.4 ± 8.0
Co	38.3 ± 4.0	Sn	5.7 ± 0.7	Th	61.8 ± 12.0
Ni	3.2 ± 0.5	Sb	106 ± 13	U	224 ± 40
Cu	3.7 ± 0.8	Te	106 ± 13	I	106 ± 12
Zn	3.4 ± 0.8				

(J.S.R.)

10948

MEAN β-RAY ENERGY AND DECAY CONSTANT OF TRITIUM. M. M. Popov, Iu. V. Gagarinskii, M. D. Senin, I. P. Mikhalenko, and Iu. M. Morozov. Atomnaya Energiya 4, 296-8(1958) Mar. (In Russian)

Uranium tritide specimens were used in the determination of the mean β-particle energy. The energy of the specimens diminished according to the exponential law which indicated the absence of side reactions and permitted the determination of the decay constant of tritium. (R.V.J.)

10949

QUADRUPOLE VIBRATIONS AND THE ELECTRIC QUADRUPOLE MOMENT OF SOME CLOSED SHELL PLUS (OR MINUS) A SINGLE NUCLEON NUCLEI. P. N. Mukherjee and I. Dutt (Inst. of Nuclear Physics, Calcutta). Indian J. Phys. 32, 149-54(1958) Mar.

A critical survey was made on the position of the quadrupole moment of closed shell plus (or minus) a single nucleon nuclei. It is found that collective model formalism of the quadrupole moment is essentially correct if one calculates the rigidity of the core from the data on the vibrational spectra of even-even nuclei. Using the available data on vibrational levels the

strength of surface coupling was calculated and it is found that in the region of closed shell, an intermediate coupling picture holds true. The values of the quadrupole moment are also improved in this scheme. (auth)

10950

RADIATIONS FROM DECAY OF BISMUTH-203, BISMUTH-204, LEAD-204m, AND BISMUTH-205. A. R. Fritsch and J. M. Hollander (Univ. of California, Berkeley). J. Inorg. & Nuclear Chem. 6, 165-80(1958) June.

A study has been made of the radiations from the neutron-deficient isotopes Bi^{203}, Bi^{204}, Bi^{205}, and Pb^{204m}, principally by conversion electron spectroscopy with four 180° electron spectrographs of the permanent-magnet type. The decay schemes of the bismuth isotopes are found to be very complex, and in spite of high-resolution studies and some coincidence work, unique level schemes cannot be given in any case. A new transition in the decay of the 1 hr Pb^{204} isomer has been identified at 289.5 kev, and this is interpreted as arising from a 4^+ state of Pb^{204} at 1563 kev. A comparison is given of the results of the present study of Bi^{205} decay with those of other recent spectroscopic studies of the Pb^{205} levels. (auth)

10951

SOME FURTHER FISSION YIELDS IN SPONTANEOUS FISSION OF ^{252}Cf. J. G. Cuninghame (Atomic Energy Research Establishment, Harwell, Berks, Eng. and Argonne National Lab., Lemont, Ill.). J. Inorg. & Nuclear Chem. 6, 181-3(1958) June.

Six new fission yields were measured on the wings of the Cf^{252} spontaneous fission curve. The width of the peaks at half maximum height is found to be 13 ± 1 mass units. (auth)

10952

MEASUREMENT OF NUCLEAR MAGNETIC MOMENTS IN ATOMIC BEAMS. G. K. Woodgate and P. G. H. Sanders (Clarendon, Lab., Oxford). Nature 181, 1395-6(1958) May 17.

A method is described for the measurement of nuclear magnetic moments in an apparatus with short A and B magnets. Three radio-frequency loops situated in the C field of an atomic-beam apparatus were employed. It is stated that the method should give the same information as that obtained from a long apparatus but with a large gain in beam intensity. It should be applicable in measuring isotopes which are radioactive or of low abundance, and atoms which can only be detected with low efficiency. Preliminary measurements on the hyperfine structure in the ground level of europium are mentioned, but no data are included. (C.H.)

10953

DIRECTIONAL DISTRIBUTION OF ALPHA PARTICLES EMITTED BY ORIENTED NUCLEI. P. J. Brussaard and H. A. Tolhoek (Universiteit van Leiden, Netherlands). Physica 24, 233-62(1958) Apr.

A theoretical investigation is made concerning the information which may be drawn from experiments on the directional distribution of alpha particles from oriented nuclei. Formulas are given connecting the directional distribution (for arbitrary nuclei) with the degree of orientation of the alpha-emitting nuclei. The theory of alpha emission of spheroidally deformed nuclei is explained, especially in view of the experiments on this directional distribution. It is discussed by which analysis typically nuclear information can be obtained from this directional distribution, which cannot be obtained from intensities in alpha fine structure or alpha-gamma directional correlation. It is shown that simultaneous observation of the directional distribution of the gamma radiation will be of interest. The nuclear information is connected with a preferential emission of the alpha particle from the poles or from the equator of the surface of the spheroidally deformed nucleus, depending on the internal problem of alpha particle formation from nucleon states. The relation between directional distributions in the laboratory system and the body fixed system can be visualized for the classical limit by a simple geometrical averaging over the precession of the nucleus. (auth)

10954

ON THE THEORY OF EMISSION OF ALPHA PARTICLES AS RELATED TO THE STRUCTURE OF THE NUCLEUS. P. J. Brussaard and H. A. Tolhoek (Universiteit van Leiden, Netherlands). Physica 24, 263-79 (1958) Apr.

The internal problem of the formation of the alpha particles emitted in alpha disintegration is considered. In this respect the mean free path of alpha particles in nuclear matter is important. A comparison is made with the optical model treatment of alpha particle scattering; the significance of the alpha particle potential well parameters is discussed. A short mean free path for the alpha particles in nuclear matter suggests that the alpha particle formation can be characterized approximately by a boundary condition on the nuclear surface, which further determines the alpha particle propagation in the external region. An approximate wave function representing a nucleus with shell structure emitting an alpha particle is proposed and provides an expression for this boundary condition. Such an expression can be used for the calculation of absolute as well as relative transition probabilities in alpha decay. The value for the radius of the alpha particle potential well, which is obtained in this way from the alpha decay probability is in good agreement with the radius of the potential well determined from alpha particle scattering. A summary is given of the experimental information which would be useful for a further test of the picture of alpha particle formation. (auth)

10955

ON THE INTERNAL BREMSSTRAHLUNG IN THE ^{204}Tl BETA DECAY. R. A. Ricci (Instituto di Fisica sperimentale del Politecnico, Turin). Physica 24, 297-303 (1958) Apr.

The experimental distribution of the internal bremsstrahlung accompanying the beta decay in Tl^{204} was measured with the scintillation technique in the energy region between 80 and 400 kev. The results obtained were compared with the theoretical distributions calculated on the basis of the Knipp and Uhlenbeck theory, where the influence of the Coulomb field of the nucleus is neglected, and with the Nilsson theory which takes the Coulomb effect into account. The experimental results agree fairly well with the Nilsson distribution in the region above 150 kev; this agreement no longer holds below this energy and an experimental excess of photons is found, which cannot be explained as due to radiation following the electron capture in Tl^{204}. The Knipp and Uhlenbeck distribution shows disagreement with the experimental one in the whole energy interval investigated. These results seem to point in the same direction as those found recently by other authors for many other nuclides. (auth)

10956

SOME MEASUREMENTS ON THE DECAY OF ^{52}Mn. J. Konijn, B. Van Nooijen, and H. L. Hagedoorn (Tech-

nische Hogeschool, Delft, Netherlands). Physica 24, 377-9(1958) May.

A value of 1.99 ± 0.06 was obtained for the capture-positron branching ratio in Mn^{52}. It is ascertained that the 6^+ level is different from any of the states previously mentioned. (W.D.M.)

10957

ELECTRODISINTEGRATION OF He^4 NUCLEUS. Toshinosuke Muto and Takashi Sebe (Univ. of Tokyo and Hosei Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 18, 621-36(1957) Dec.

The inelastic continuum of scattered electrons by He^4 nuclei, observed experimentally by the Stanford group, is worked theoretically by using the conventional forms of wave functions for He^4, He^3, and the triton. It is pointed out that two kinds of scattering are involved in the cross section; one is connected with the direct process in which a nucleon can be ejected through the direct interaction with the electromagnetic field induced by the electron, the other is connected with the indirect process in which a nucleon is capable of being ejected through the intermediary of nuclear interaction with another nucleon which does interact with the electromagnetic field. Comparison with experiments appears to be rather good, though qualitatively, allowing for the approximate nature of the method of computation. The main nuclear reaction connected with the observed inelastic continuum is shown to be the ejection of nucleon from He^4 except for the low-energy tail where the pion production is observed to take place according to the Stanford group. (auth)

10958

ON THE GROUND STATE SPIN OF Ti^{47} AND Mn^{55}. Sadaaki Yanagawa (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 18, 661-2(1957) Dec.

Lawson and Uretsky have shown that it is possible to compute the energy splittings for the configuration by making use of the excitation energies for the $(f_{7/2})^{\pm 2}$ or $(f_{7/2})^4$ given by experimental measurements in nuclei with $(f_{7/2})^n$ protons and 28 (closed shell) neutrons. Talmi has also taken the same procedure in nuclei with $(f_{7/2})^n$ neutrons and 20 (closed shell) protons. In these nuclei it may be noted that the energy splitting E(2) between the first excited state and the ground state for $(f_{7/2})^{\pm 2}$ shows a nearly constant value; 1.4 to 1.6 Mev. This regularity would give a more sensitive effect to lowering the state ($^7/_2$) than the state ($^5/_2$) of nuclei for $(f_{7/2})^{\pm 3}$ configuration; (Ca^{43}, Ca^{45}, V^{51}, and Mn^{53}). A summary of calculations together with the known experimental information is tabulated. (A.C.)

10959

LOW LYING LEVELS OF P^{32} AND jj COUPLING. Sudhir P. Pandya (Physical Research Lab., Ahmedabad, India). Progr. Theoret. Phys. (Kyoto) 18, 668-9(1957) Dec.

An attempt is made to explain the observed l = 0 and 1 transitions in P^{31}(d,p) reactions, reported by Dalton, Hinds, and Parry, in terms of small deviations from jj coupling. (D.E.B.)

10960

IDENTIFICATION OF THE INTERNAL CONVERSION SPECTRUM OF THE LONG-LIVED ISOTOPES Eu^{152} AND Eu^{154}. B. V. Bobykin and K. M. Novik (Physico-Tech. Inst., Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 322-5(1957) July-Aug.

The internal conversion spectra of the 13-year Eu^{152} and the 16-year Eu^{154} were investigated using a double-focusing β spectrometer. Conditions favorable to work in a broad range of fields (14 to 270 oersteds, electron energies of 10 to 1500 kev) were produced by special preparation of the magnet. In the majority of cases both the K and L conversion lines were registered from samples more than two years old. The energy was determined with less than 0.1% error. 73 internal conversion lines and 13 lines of Auger electrons were observed, and the identified gamma transitions are tabulated. The excited levels of Sm^{152}, Gd^{152}, and Gd^{154} are established. (J.S.R.)

10961

LOWEST EXICTED LEVELS OF AXIALLY SYMMETRIC EVEN-EVEN NUCLEI. G. F. Filippov. Soviet Phys. (Doklady) 2, 378-80(1957) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 1600.

10962

EXPERIMENTAL STUDIES OF THE ALPHA DECAY OF MEDIUM-WEIGHT NUCLEI. Iu. A. Surkov (V. I. Vernadskii Inst. of Geochemistry and Analytic Chemistry, Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 396-8(1957) July-Aug.

An experimental investigation of alpha decay was made in isotopes with N = 82 to 126. The alpha-active isotopes were obtained by irradiating erbium, ytterbium, and hafnium with protons from 70 to 660 Mev. The elements were then separated chromatographically and were identified by their various forms of radioactive decay. Alpha-active isotopes Gd^{148}, Tb^{149}, Dy^{152}, $Dy^{(153)}$, and $Hf^?$ were observed. The isotopes 9153 $Dy^{(153)}$ and $Hf^?$ were presumed to be new, and the mass numbers could not be assigned definitely. The energy of the alpha emission and the half lives is tabulated. (J.S.R.)

10963

POLARIZATION OF PROTONS SCATTERED BY O^{16}. SPIN AND PARITY OF THE 3.11-Mev LEVEL OF THE F^{17} NUCLEUS. P. V. Sorokin, A. K. Val'ter, B. V. Gavrilovskii, K. V. Karadzhev, V. I. Man'ko, and A. Ia. Taranov (Physico-Tech. Inst., Academy of Sciences, Ukrainian, SSR). Soviet Phys. JETP 6, 466-9(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3185.

10964

COLLECTIVE EXCITATIONS OF EVEN-EVEN NUCLEI. A. S. Davydov and G. F. Filippov (Moscow State Univ.). Soviet Phys. JETP 6, 555-60(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3186.

10965

NEW NUCLEAR DATA. 1957 CUMULATION. M. Yamada, ed., G. H. Fuller, D. N. Kundu, J. B. Marion, C. L. McGinnis, and K. Way. Washington, National Research Council, 1958. 167p. Available from U. S. Government Printing Office, Washington, D. C., for $1.25.

Nuclear data collected from 44 journals from about November 1956 to August 1957 is cumulated. The data from Nuclear Science Abstracts, Vol. 11, nos. 6B and 12B are included. A separate list of data on elastic and inelastic scattering of charged particles is a new feature of this cumulation, and it covers experimental data appearing since 1950. The tabular presentation of previous cumulations is retained. (T.R.H.)

Nuclear Reactors

Refer also to abstracts 10553, 10672, 11198, 11199, 11200, 11201, and 11204.

10966 AECU-3559
Studebaker-Packard Corp. Nuclear Power Dept., Detroit.
GAS COOLED NUCLEAR REACTOR STUDY. Final Report. A. S. Thompson. July 31, 1956. 110p. Contract AT(30-3)-214. $3.00(OTS).

An investigation was made of the performance of a gas-cooled reactor, designed to provide a source of high temperature heat to a stream of helium. This reactor, in turn, is used as a source of heat for the air stream in a gas-turbine power plant. The reactor design was predicted primarily on the requirement for transferring a large amount of heat to the helium stream with a pressure drop low enough that it will not represent a major loss of power in the power plant. The mass of uranium required for criticality under various circumstances was investigated by multigroup calculations, both on desk calculators and on an IBM-704 machine. The gas-turbine power plant performance was studied based on a Studebaker-Packard-designed gas-turbine power plant for the propulsion of destroyer-escort vessels. A small experimental program was carried out to study some effects of helium on graphite and on structural steels. (auth)

10967 AECU-3657
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
CHEMICAL ENERGY RELEASE IN A NUCLEAR REACTOR EXCURSION. Period covered: May 1, 1957 to February 1, 1958. Francis Narin and D. Krucoff. Jan. 17, 1958. 65p. ARF Project No. D132A01. Contract AT(11-1)-528.

A method was devised, based on fuel element temperature distributions, for estimating the chemical reaction which might result from a very rapid nuclear reactor transient. (auth)

10968 AECU-3697
ASTRA, Inc., Milford, Conn.
THE EFFECT OF SODIUM VAPOR FORMATION ON THE OPERATION OF THE ENRICO FERMI REACTOR—AN ESTIMATE. H. R. Kroeger and J. W. Stephenson. July 1957. 53p. (ASTRA-471-E-1.1). $9.30(ph OTS); $3.60(mf OTS).

The results of calculations concerning two-phase sodium flow in the Fermi Fast Breeder Reactor are presented. The large specific volume of sodium vapor coupled with the resistance of the top axial blanket section resulted in large pressure drops for small values of net vapor. Once the coolant reached the saturation temperature, the pressure drop resulting from vapor formation exceeded the added pressure drop from flow reduction. Although there appears to be a region of stable operation with vapor formation, the lowest value of pressure drop in this region is much greater than that at the initiating flow rate. It is concluded that any vapor formation in the reactor produces an unstable condition which would lead to burnout. (D.E.B.)

10969 AECU-3747
Atomic Power Development Associates, Inc., Detroit.
SPECIFICATION FOR CLEANING METAL COMPONENTS AND SYSTEMS FOR LIQUID-METAL COOLED POWER REACTORS. Specification No. 10-16. L. R. Kovac. Jan. 13, 1958. 10p. $1.80(ph OTS); $1.80 (mf OTS).

The degree of cleanliness is defined, and the methods and materials to be used are outlined for carbon and low alloy steels, 300 and 400 series ferritic and austenitic stainless steels, special Ni–Cr base heat-resistant hard-facing and high-temperature brazing alloys, and some non-ferrous materials. (T.R.H.)

10970 AERE-M/TN-36
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
ON THE EFFECTS OF REACTOR CONDITIONS ON AQUEOUS DISPERSE SYSTEMS. P. J. Anderson. Jan. 30, 1956. Decl. Apr. 18, 1958. 25p.

The problem of the deposition of corrosion products on the test sections of loops is discussed from the point of view of colloid science. (auth)

10971 AERE-N/R-130
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
CALIBRATION OF CONTROL AND SHUTOFF RODS IN GLEEP BY RELAXATION TIME MEASUREMENTS. Dec. 5, 1947. Decl. Apr. 18, 1958. 13p.

Measurements were made to determine the effectiveness of the control and shutoff rods in Gleep. The changes in the reproduction factor of the pile, brought about by these rods, were determined by relaxation time measurements. Some preliminary information was also obtained on the effects of pressure and temperature changes on the reproduction factor. (auth)

10972 AERE-N/R-162
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE THERMAL-NEUTRON FLUX DISTRIBUTION IN GLEEP, TOGETHER WITH A DEFINITION OF THE GLEEP UNIT OF POWER. E. Lockett and J. C. C. Stewart. Jan. 30, 1948. Decl. Apr. 18, 1958. 13p.

Detailed information on the thermal flux available throughout the experimental holes of GLEEP is presented. (D.E.B.)

10973 AERE-R/R-2387
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE CHANGE IN REACTIVITY OF A PILE DURING OPERATION. J. Codd and J. F. Hill. Apr. 1951. Decl. with amendment June 1957. 17p. $0.54(BIS).

Declassified version of AERE-R/R-671.

A formula is developed for the change in reactivity of a pile during operation due to changes in the composition of the fissile and fertile material, namely, destruction of U^{235} and U^{238} and buildup of Np^{239} and Pu^{239}. The results are applied to a typical natural uranium pile and to enriched reactors. (auth)

10974 AERE-T/M-159
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
CALCULATION OF FISSION PRODUCT ACCUMULATION. E. G. H. Crouch. Mar. 1958. 13p. $0.45(BIS).

The program "Other Poisons" Calculation, written for the Ferranti Mark I computer at Aldermaston, computes the total poisoning in a reactor at required times for given reactor conditions and given fission-product chains. Poisoning for each fission-product chain can be printed out if required. (auth)

10975 AERE-T/R-2487
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A PROGRAMME FOR SOLVING THE MULTIGROUP NEUTRON DIFFUSION EQUATIONS IN TWO SPACE DIMENSIONS ON THE FERRANTI MERCURY COMPUTER. A. Hassitt. Feb. 1958. 42p.

The program solves automatically the multi-energy group neutron diffusion equations in either xy or rz geometry. A description is given of the way in which the data is to be set out. In order to use the program, it is not necessary to know how it works, but for completeness, the later sections of the report outline the methods of computation used. (auth)

10976 AGN-8
Aerojet-General Nucleonics Corp., San Ramon, Calif.
SAFETY CONSIDERATIONS FOR NUCLEAR MERCHANT SHIPS. R. A. Fayram and H. J. Schneider. Oct. 15, 1956. 32p.

Rapidly increasing research and development work on nuclear-powered ships requires study of the safety problems which may arise. The results of a preliminary study which was intended to define the subject and to outline the major considerations involved are summarized. Emphasis is placed on possible directions for developing some safety measures, and on areas which need further attention. The central questions of nuclear-ship safety concerns unforeseen accidents, with the accompanying possible release of serious quantities of radioactive fission products and fuel materials. Accidents which may occur in or near contained bodies of water (the smaller seas), harbors and ports, and coastal waters, are of especial interest. The diffusion of fission products from a point source in sea water is considered. A possible means of inhibiting the biological activity of fission products is described. Radioactivity hazards are estimated. (auth)

10977 APAE-11
Alco Products, Inc., Schenectady, N. Y.
PREDICTED CORE PERFORMANCE FOR THE ARMY PACKAGE POWER REACTOR NO. 1. F. B. Fairbanks, ed. Aug. 31, 1956. Decl. Mar. 14, 1957. 96p. Contract AT(11-1)-318. $2.50(OTS).

The predictions of APPR-1 core performance at zero power and for its operating life are reported, with a description of the methods employed. The window shade model has been used to predict a temperature coefficient of -0.5×10^{-4} $\Delta k/°F$ at 68°F and -3.2×10^{-4} $\Delta k/°F$ at 450°F. The lifetime based on uniform material burnup is calculated to be 12.1 MW-yr for a reactor with equilibrium xenon and samarium and 2% available reactivity. If non-uniform burnup effects are considered, the lifetime decreased to 9.1 MW-yr for the same conditions. (auth)

10978 APAE-21
Alco Products, Inc., Schenectady, N. Y.
EXTENDED ZERO POWER EXPERIMENTS ON THE ARMY PACKAGE POWER REACTOR–ZPE-2. J. W. Noaks, ed. Nov. 15, 1957. 204p. Contract AT(30-3)-278. $5.00(OTS).

Experiments were performed using APPR-1 fuel elements in cores having various diameters, metal to water ratios and boron-10 distributions. The presence of steel in the reflector made a noticeable increase in the core reactivity under certain circumstances. A relatively simple technique was used to determine the gamma dose rates through shielding materials yielding values in reasonable agreement with theory. Many gross and fine structure traverses were made with gold, indium and uranium foils including traverses in cores with uniform and non-uniform poison distributions and various control rod configurations. Temperature coefficients of reactivity were nearly identical for various cores from 65 to 130°F. (auth)

10979 BMI-1265
Battelle Memorial Inst., Columbus, Ohio.
A MODIFIED PILE OSCILLATOR FOR NEUTRON CROSS-SECTION MEASUREMENTS. James N. Anno, Richard G. Jung, and Joel W. Chastain, Jr. May 8, 1958. 42p. Contract W-7405-eng-92. $1.25(OTS).

A pile oscillator was designed, constructed, and operated at the Battelle Research Reactor. This pile oscillator cycles a specimen and a standard in the same container through an annular ion chamber located in the thermal column. This almost simultaneous oscillation of the standard and specimen eliminates errors caused by power drifts or fluctuations. The use of a continuous graphite rod for the container or carrier reduces undesirable scattering effects of the carrier. The oscillator was calibrated using the cross section of gold foil as a standard. Effects of geometry on measured cross sections were investigated. In general, larger samples gave higher apparent cross-section values than thin foils of comparable cross sections. Most measurements to date were made on powdered-metal samples. Values obtained at Battelle are presented and compared with values from Oak Ridge on similar samples. At present the sensitivity of the oscillator is limited to total absorption cross sections on the order of 1 mm^2 for accurate cross-section data. The limit of the accuracy of the measurements is approximately the accuracy to which the absorption cross section of the standard sample is known. An analysis of the errors indicates that cross sections on the order of 1 mm^2 can be measured to accuracies within ± 5% without further modification of the oscillator. In general, the accuracy increases as the cross section is increased. (auth)

10980 BNL-3600
Brookhaven National Lab., Upton, N. Y.
PRELIMINARY DESIGN OF A REACTOR PRODUCING PROCESS STEAM AND COBALT 60. C. W. Pierce and D. M. Richman. Sept. 1957. 20p. $3.30(ph OTS); $2.40(mf OTS).

The feasibility of a He-cooled, graphite-moderated reactor for use as a heat source for a gasoline fractionating unit and for production of Co^{60} is discussed. The over-all dimensions of the reactor are a core radius of 9.3 ft and a core length of 20.25 ft which must be contained in a pressure vessel designed for 10 atmosphere pressure and a temperature of about 600°F. At the design power level of 50 Mw, 1.96 megacuries of Co^{60} with 15.1 c/g specific activity can be produced. An enriched 14% U–Al alloy clad with Alcoa alloy X-2219 was selected as the fuel element. The cost factors of such a reactor are detailed. (M.H.R.)

10981 CF-58-4-126
Oak Ridge National Lab., Tenn.
TABULATION OF LINE LENGTHS, AREAS, AND VOLUMES IN THE HRT FUEL AND BLANKET LOW-PRESSURE SYSTEMS. R. Van Winkle. Apr. 22, 1958. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

The tabulation of pipe lengths, with calculated surface areas and volumes, was assembled from physical measurements of the process piping. Included also is a

list of instrument lines, with their measured lengths and estimated volumes. (auth)

10982 CF-58-5-79
Oak Ridge National Lab., Tenn.
EXPERIMENTAL DETERMINATION OF HRE-3 BREEDING RATIO. M. W. Rosenthal. May 27, 1958. 11p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80 (mf OTS).

The accuracy with which the breeding ratio of HRE-3 could be determined after a period of reactor operation was investigated. Inaccuracies in measurement of the core U^{233} inventory and blanket U^{233} and Pa^{233} inventories appear to be the major sources of error. Appreciable errors could result from attempting to determine these inventories by sampling the reactor contents. For example, if generalized attack on stainless steel is at a rate of 1.0 mpy and if the associated film of corrosion products is 1% uranium, failure to account for this fuel in evaluation of the core inventory would cause an error of about 5% in the breeding ratio. (auth)

10983 CF-58-5-97
Oak Ridge National Lab., Tenn.
TEMPERATURE STRUCTURE IN GAS COOLED REACTOR FUEL ELEMENTS AND COOLANT CHANNEL. L.G. Epel and W. T. Furgerson. May 27, 1958. 24p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

An analysis of the temperature structure in the GCR-2 fuel elements and coolant stream at the position where the maximum fuel element surface temperature exists is presented. Results were obtained by numerical methods on the IBM 704 digital computer. The effect of variation in channel size is shown, and a method of data correlation is suggested. Preliminary conclusions are presented as to the effect of temperature structure on the design and testing of gas cooled reactor fuel element configurations. In view of the rate at which gas cooled reactor work is proceeding results of the calculations are being published in their current incomplete form. The study is continuing in an effort to refine the calculations, and experimental data will eventually be available with which to verify the analytical conclusions. (auth)

10984 CF-58-5-100
Oak Ridge National Lab., Tenn.
AN ANALYSIS OF THE MAGNESIUM–CO_2 REACTIONS IN TERMS OF A REACTOR ENVIRONMENT. J. L. Scott. May 15, 1958. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The hazards associated with the use of magnesium capsules in a CO_2-cooled reactor system have been analyzed, and consideration has been given to incidents which could lead to excessive temperature excursions and factors which could significantly reduce the ignition temperature of magnesium alloys. Methods of reducing the hazards associated with the Calder Hall type of reactor are discussed, and an experimental approach with which to define more accurately conditions that would lead to ignition is suggested. (auth)

10985 CF-58-5-101
Oak Ridge National Lab., Tenn.
EXTENDED LENGTH HRE-3 SLURRY DUMP LINE TO REPLACE THROTTLING DUMP VALVE. L. A. Haack. May 22, 1958. 25p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

From the standpoint of erosion, a long dump line may be preferable to a throttling dump valve to achieve the pressure drop from the HRE-3 slurry blanket to the dump tank. Extended length HRE-3 dump lines in which the maximum average velocity is 20 fps, the smallest allowable line size is ½ in., and the time for dumping is 10 minutes are investigated. Twenty-six parallel ½-in. Sch. 80 pipes, each 725 ft long, or four parallel 1½-in. Sch. 80 pipes each 2,000 ft long are required. To avoid localized velocities considerably higher than 20 fps as a result of flashing, these pipes can be submerged in a 28,000 gal pool of water initially at 135°F and with 40°F allowable temperature rise. It can be concluded that if the velocity, line size, and dumping time are limited to the values listed above, use of restrictor piping to achieve the pressure drop is not very practical. If higher velocities and flashing are allowed, a cursory study indicates that for an average velocity in the range from 100 to 200 fps, one 1¼-in. (or smaller) line of less than 250-ft length could be used. Flashing would occur, and sonic velocities with high erosion rates would exist at the exit. Experimental data will be required to evaluate friction factors, heat transfer characteristics, and erosive-corrosive effects of three-phase flashing flow. (auth)

10986 HW-55905
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PLUTONIUM RECYCLE PROGRAM MONTHLY REPORT [FOR] APRIL 1958. F. W. Albaugh, L. P. Bupp, P. F. Gast, and L. H.McEwen. May 15, 1958. 19p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Progress is reported briefly in development of fuel element materials, instrumentation, and mechanical equipment for the PRPR. (For preceding period see HW-55590-A2.) (W.L.H.)

10987 IDO-2021(Rev. 1)
Kaiser Engineers Div., Henry J. Kaiser Co., Oakland, Calif. and Nuclear Products-Erco Div., ACF Industries, Inc., Washington, D. C.
PRELIMINARY DESIGN, 55,000 KW PROTOTYPE NATURAL URANIUM, GAS COOLED, GRAPHITE MODERATED NUCLEAR POWER PLANT (PROTOTYPE FOR AN OPTIMUM PLANT). (Cover carries title: GAS COOLED POWER REACTOR, PRELIMINARY DESIGN, 55,000 KW PROTOTYPE NATURAL URANIUM NUCLEAR POWER PLANT.) Report No. 58-1-RE. Mar. 1958. Revision 1, Apr. 1, 1958. 126p. Contract AT(10-1)-925. $2.75(OTS).

The preliminary design parameters, cost estimates, and schedules for a gas-cooled, natural uranium, graphite-moderated power plant are discussed. The plant is designed as a 55-Mw prototype of an optimum plant rated at 220 Mw and consists primarily of one multipurpose building which houses the reactor plant, turbine generator, warehouses, and offices. Other facilities considered include the induced draft cooling tower, a substation, and necessary utilities. Estimated costs are: design and construction $990 per kw (gross electrical) and power produced 32 mills per kw-hr of which fixed charges are 26 mills per hw-hr. The physical size of the prototype is the minimum which provides sufficient reactivity to permit 3,000 Mwd per metric ton average fuel lifetime with natural uranium. The maximum operating pressure and temperature for this fuel lifetime are 285 psia and 800°F. (W.D.M.)

10988 IDO-2022(Rev. 1)
Kaiser Engineers Div., Henry J. Kaiser Co., Oakland, Calif. and Nuclear Products-Erco Div., ACF Industries, Inc., Washington, D. C.
FEASIBILITY STUDY, OPTIMUM NATURAL URANIUM, GAS COOLED, GRAPHITE MODERATED NUCLEAR POWER PLANT. (Cover carries title: GAS COOLED

POWER REACTOR, FEASIBILITY STUDY, OPTIMUM NATURAL URANIUM NUCLEAR POWER PLANT.) Report No. 58-2-RE. Mar. 1958. Revision 1, Apr. 1, 1958. 88p. Contract AT(10-1)-925. $2.25(OTS).

The feasibility, design, and cost estimates for a gas-cooled, graphite-moderated, natural uranium power plant optimized for minimum power cost are discussed. The plant consists primarily of one multi-purpose building which houses the reactor plant, turbine generator, warehouses, and shop. Other facilities include an office building, river pump house, substation, and necessary utilities. The estimated design and construction cost of the 220 Mwe (net) is 540 per kw (gross electrical). This excludes costs of the switchyard and transmission lines. The estimated cost of power produced is 19 mills per kw-hr of which fixed charges are 15 mills per kw-hr, based on a lifetime plant factor of 80%, annual fixed charges at 14%, and accepted utility plant accounting practices. Maximum outlet gas temperature and pressure are 800°F and 275 psia with a net plant efficiency of 31.4%. The steam power plant consists of eight steam generators which supply steam at dual pressures to a cross-compound turbine generator unit. (W.D.M.)

10989 IDO-2023(Rev. 1)

Kaiser Engineers Div., Henry J. Kaiser Co., Oakland, Calif. and Nuclear Products-Erco Div., ACF Industries, Inc., Washington, D. C.

FEASIBILITY STUDY, 44,000 KW PROTOTYPE PARTIALLY ENRICHED URANIUM, GAS COOLED, GRAPHITE MODERATED NUCLEAR POWER PLANT (PROTOTYPE FOR AN OPTIMUM POWER PLANT). (Cover carries title: GAS COOLED POWER REACTOR, FEASIBILITY STUDY, 44,000 KW PROTOTYPE PARTIALLY ENRICHED URANIUM NUCLEAR POWER PLANT). Report No. 58-3-RE. Mar. 1958. Revision 1, Apr. 1, 1958. 81p. Contract AT(10-1)-925. $2.25(OTS).

A discussion of the feasibility study and cost estimates for a gas cooled, partially enriched uranium, graphite moderated, 44 Mwe power plant is presented. The plant is designed as a prototype of a 220 Mwe plant and consists of four adjoining buildings which house the reactor plant, turbine generator, warehouses, and offices. Other facilities include the induced draft cooling tower, a substation, and necessary utilities. The estimated costs of the 44 Mwe prototype are: design and construction $960 per kw (gross electrical), and power produced 32 mills per kwhr of which fixed charges are 25 mills per kwhr. Outlet gas temperature and pressure of 1000°F and 387 psia give a net thermal efficiency of 35.3%. The degree of enrichment is selected to provide an average fuel element lifetime of 10,000 Mwd per metric ton. (W.D.M.)

10990 IDO-2024(Rev. 1)

Kaiser Engineers Div., Henry J. Kaiser Co., Oakland, Calif. and Nuclear Products-Erco Div., ACF Industries, Inc., Washington, D. C.

FEASIBILITY STUDY, OPTIMUM PARTIALLY ENRICHED URANIUM, GAS COOLED, GRAPHITE MODERATED. (Cover carries title: GAS COOLED POWER REACTOR, FEASIBILITY STUDY, OPTIMUM PARTIALLY ENRICHED URANIUM NUCLEAR POWER PLANT.) Report No. 58-4-RE. Mar. 1958. Revision 1, Apr. 1, 1958. 78p. Contract AT(10-1)-925. $2.00 (OTS).

The feasibility study and cost estimates for a gas-cooled, partially enriched uranium, graphite-moderated, 215-Mwe power plant optimized for minimum power cost are discussed. The plant consists of one multi-purpose building which houses the reactor plant, turbine generator, warehouses, and shop. Other facilities include an office building, river pump house, substation, and necessary utilities. The estimated costs are: design and construction $410 per kw-hr (gross electrical), and produced power 15 mills per kw-hr of which fixed charges are 12 mills per kw-hr. The 2.5% enrichment is selected to provide an average fuel element lifetime of 10,000 Mwd per metric ton. The outlet gas temperature and pressure of 1000°F and 370 psia give a net thermal efficiency of 35.8%. (W.D.M.)

10991 IDO-16052

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

OXIDATION OF MTR GRAPHITE REFLECTOR. C. F. Leyse. Dec. 22, 1952. Decl. May 8, 1958. 8p. $1.80 (ph OTS); $1.80(mf OTS).

A recent report, CRNE-507, "The Effect of Pile Irradiation on the Oxidation of Graphite," has been applied to the MTR. This information indicates that oxidation of MTR graphite will cause maximum weight losses of about 3%/year and 0.6%/year in the graphite pebbles and permanent graphite, respectively. The average weight losses are estimated to be about 0.4%/year in the graphite pebbles and about 0.17%/year in the permanent graphite. Thus, there should not be any difficulties with the MTR due to oxidation of the graphite reflector. (auth)

10992 IDO-16420

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

MTR CHARGE LIFE WITH MIXTURES OF U^{235} AND Pu^{239}. H. L. McMurry. Oct. 23, 1957. 14p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

An equation for the cycle time of an MTR fuel charge containing mixtures of U^{235} and Pu^{239} fuels is presented. The role of captures in the resonances at 0.3 ev in Pu^{239} and 1 ev in Pu^{240} is included. As a by-product, the equations permit estimating the amount of Pu^{239} per fuel assembly needed to give the same cycle time as an arbitrary distribution of U^{235} fuel for which the cycle time is known. It avoids some of the simplifications employed in earlier work on this problem. Once the proper weight factors have been determined, the equations can be solved readily by hand. However, they can easily be programmed for machine solution. (auth)

10993 IDO-16428

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

IN-TANK IRRADIATION FACILITIES IN THE MTR AND ETR. STANDARD PRACTICES MANUAL. A. S. Richardson, ed. Apr. 1, 1958. 80p. Contract AT(10-1)-205. $2.25(OTS).

An aid to experimenters in planning and designing capsule-type irradiations for the MTR and ETR is presented. The facilities available for capsule-type irradiations are described, and standard capsules, capsule holders, and basket designs are given. A generalized discussion of typical designs of various types of capsules is included. In addition, the requirements for irradiation of capsule-type experiments are presented. (auth)

10994 IDO-16459

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

PRELIMINARY EVALUATION OF THE 20% ENRICHED URANIUM CORE FOR THE MATERIALS TESTING REACTOR. D. R. deBoisblanc and R. S.

Marsden. June 3, 1958. 24p. Contract AT(10-1)-205. $0.75(OTS).

In November, 1957 the MTR was successfully operated on 20% enriched fuel for 646 Mwd, of which 550 were at the original MTR design power of 30 Mw. This power level was selected before the experiment on the basis of heat transfer limitations imposed by the use of a uniform fuel distribution. The plate spacing of the fuel elements deviated from specifications and it was necessary to select fuel elements and their placement in the core. One fuel element developed a pinhole in the cladding and released gaseous fission products soon after the start of operation at high power. Although the level of the fission products did not necessitate shutting down the reactor, the defective fuel element was replaced as a precaution. No further difficulties occurred which could be attributed to the core. A number of reactor physics measurements preceded the operation at power. The results of some of these measurements and other important items are listed. (auth)

10995 ISC-318(Del.)
Ames Lab., Ames, Iowa.
THE MOLTEN-METAL-FUEL REACTOR. F. H. Spedding. June 1953. Decl. with deletions Apr. 1958. 6p. Contract W-7405-eng-82. $0.50(OTS).

A general discussion of the history, advantages, and problems of the molten-metal-fuel reactor is given. A drawing is included showing preliminary plans for a molten-metal enriched fast reactor with molten-metal extraction of impurities and Pu. (M.H.R.)

10996 KAPL-M-D1G-TD-1
Knolls Atomic Power Lab., Schenectady, N. Y.
SUMMARY OF KAPL (D1G) INVESTIGATION OF BURNOUT DURING PERIOD FEBRUARY 19, 1958 THROUGH MAY 6, 1958. J. Longo, Jr. May 14, 1958. Appendix A. STATUS OF EVALUATION OF WAPD-TH-188 RECTANGULAR CHANNEL BURNOUT CORRELATION. Mar. 5, 1958. Appendix B. PROGRESS REPORT FOR STATISTICAL EVALUATION OF BURNOUT WITH WATER FLOWING IN RECTANGULAR CHANNELS AT 2000 PSIA. Mar. 26, 1958. 33p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30(mf OTS).

Results of the KAPL D1G investigation of burnout with water flowing upward in rectangular channels at 2000 psia are presented. Interim equations to predict burnout in these channels are presented, and it is recommended that a physical model of burnout should be made available to contrast with present correlations. The evaluation procedure for WAPD-TN-188 was set up and all 2000 psi rectangular upflow data compiled, along with the standard error of estimating the WAPD-TH-188 model. A survey of the data and literature on statistical analysis of burnout with water flowing in rectangular channels at 2000 psia was made, and an outline of a proposed extension of the present analysis is presented, suggesting a method of simplification of calculations to cut down machine time. (J.R.D.)

10997 KAPL-M-DOM-3
Knolls Atomic Power Lab., Schenectady, N. Y.
START-UP ACCIDENT ANALYSIS. Daniel R. MacNaughton. Mar. 21, 1958. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Analog computer studies are made of two main areas of interest during a start-up accident; the ability of drivedown circuitry to shut down the reactor before reaching the power range, and the self shut-down characteristics of the reactor if the accident progresses into the power range. The results indicate that period drivedown circuitry would have to take effect at 10^{-5}% power to be effective. An expression relating the fuel element time constant, shim Δk rate, time after reaching 5% power, and negative temperature coefficient to the energy released in full power seconds is obtained. (auth)

10998 KAPL-M-HS-9
Knolls Atomic Power Lab., Schenectady, N. Y.
NUCLEAR REQUIREMENTS FOR CONTROL MATERIALS. H. E. Stevens. Nov. 7, 1957. 22p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

Nuclear factors that affect the effectiveness of control rod materials for power reactors with a thermal or near thermal neutron spectrum are described. The principal elements and isotopes which qualify as neutron absorbers are described and physical requirements, such as, rod thickness, surface density, and weight ratios are compared. The importance of epithermal absorption and the nuclear effects of burnup as a result of long neutron exposure in power reactors are shown. The characteristics of absorption isotope chains, such as, europium are described, and finally, the deleterious effects of cladding and scattering cross section of poison diluents on control effectiveness are shown. (auth)

10999 KAPL-M-PF-5
Knolls Atomic Power Lab., Schenectady, N. Y.
VELOCITY DEPRESSION DUE TO THE WALL BOUNDING A MATRIX OF REACTOR FUEL ELEMENTS. J. P. Fraser. Apr. 1958. 17p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

In the region of the matrix immediately adjacent to the bounding wall, the average fluid velocity may be expected to differ from that existing in the matrix far from the wall. This velocity difference is of interest in water-cooled cores where the burnout heat flux is highly dependent on velocity. A simple approximate analytical method is developed for predicting the macroscopic velocity profile when the matrix is bounded by two parallel planes. The velocity depression obtained experimentally near the end of a narrow rectangular channel is compared to that predicted by this method showing fair agreement. Then the method is used to predict the velocity depression near the bounding wall for a twisted ribbon element matrix showing the effect of slot width and the grouping. (auth)

11000 KAPL-M-SMS-91
Knolls Atomic Power Lab., Schenectady, N. Y.
TRANSIENT PERFORMANCE ANALYSIS OF THE S3G/S4G DEAERATING FEED TANK. Leonard A. Savastio. May 5, 1958. 23p. Contract W-31-109-Eng-52. $4.80 (ph OTS); $2.70(mf OTS).

A theoretical analysis of the transient performance of the S3G/S4G deaerating feed tank during up-power maneuvers is presented. The criteria of satisfactory performance are based on maintaining an adequate net positive suction head on the inlet of the feed booster pump to prevent cavitation of the booster pump during design power excursions of the main propulsion turbine and its auxiliaries. Excessive feed booster pump cavitation will cause loss of main feed pump pressure. This action will close the steam drum stop valves and finally result in reactor shutdown. (W.D.M.)

11001 NAA-SR-2150
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ORGANIC MODERATED REACTOR EXPERIMENT QUARTERLY PROGRESS REPORT [FOR] JANUARY–MARCH 1957. C. A. Trilling, ed. Feb. 15, 1958. 47p. Contract AT(04-3)-88. $1.50(OTS).

An analysis was made of differences between batch and individual blending in the manufacture of OMRE fuel plates. The analysis of variance is presented. The variation of uranium density and stainless steel density as a function of oxide content is plotted. Experimental heat transfer and fouling runs with unirradiated Santowax-R were completed, and results are given. A drop calorimeter was designed for the determination of the heat capacity of organic coolants at temperatures up to 900°F. Gas compositions were determined for the decomposition gases from the following materials circulated in the organic in-pile loop: isopropyl diphenyl, diphenyl, Santowax R, and Santowax OM. The effect of radiation decomposition on the melting point of Santowax OM was determined. The carbon and hydrogen content of irradiated coolants is being determined in order to determine the change in moderating properties of the coolant due to decomposition. The variation of the density of isopropyl diphenyl as a function of temperature with high-boiler residue content as a parameter is graphically illustrated. The density is seen to increase about 5% over the temperature range 280 to 800°F as the residue content increases from 0 to 27%. An analysis of diphenyl, utilizing neutron-induced activity to determine contamination, was completed for the OMRE reactor coolant charge. Gross gamma activity and concentration in parts per million of the major contaminants are reported. (For preceding period see NAA-SR-1850.) (M.H.R.)

11002 NDA-64-101

Nuclear Development Corp. of America, White Plains, N. Y.

DESIGN OF AN EXPERIMENTAL REACTOR FOR HIGH OPERATING TEMPERATURES. L. Davidson, J. DeFelice, and J. A. Klapper. Sept. 28, 1956. 141p. Contract AT(30-1)-862. $2.75(OTS).

A preliminary design of a nuclear reactor to operate at 2500°F is described. The reactor is a prototype of a process heat reactor. There are two power producing regions in the reactor: an inner, He-cooled 2500°F region and an outer, water-cooled low temperature region. (auth)

11003 NPG-171

Nuclear Power Group, Chicago and Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.

SINGLE-FLUID TWO-REGION AQUEOUS HOMOGENEOUS REACTOR POWER PLANT; CONCEPTUAL DESIGN AND FEASIBILITY STUDY. Final Report. July 1957. 385p. (BAW-7) $5.00(OTS).

The feasibility of a 150 Mwe aqueous homogeneous nuclear power plant was investigated by a joint study team of the Nuclear Power Group and The Babcock & Wilcox Company. In this concept, the reactor is a single-fluid two-region design in which the fuel solution circulates through the thoria pellet blanket as the coolant. Components and plant arrangement were designed to provide maximum overhead accessibility for maintenance. All components in contact with reactor fuel at high pressure are themselves enclosed in close-fitting high-pressure containment envelopes. (auth)

11004 ORNL-2509

Oak Ridge National Lab., Tenn.

PREPARATION OF ThO_2 FOR HOMOGENEOUS REACTOR BLANKET USE. R. L. Pearson, K. H.McCorkle, C. V. Ellison, and P. A. Haas. June 16, 1958. 20p. Contract W-7405-eng-26. $0.75(OTS).

The flowsheet for making thorium oxide in 284-lb batches provides for adding 1M oxalic acid to 1M $Th(NO_3)_4$ cooled to 10°C. The oxalate is digested, washed, and step-calcined to 1600°C for 4 hr. After classification the final product has an average particle size close to 1 μ with less than 2 wt % larger than 5 μ. In laboratory studies thorium oxalate prepared by adding oxalic acid solution to thorium nitrate solution was more uniform and had a smaller average particle size than that prepared by mixing the solutions in reverse. The average particle size of the oxide decreased with decreasing oxalate precipitation temperature and increasing reagent concentration. More uniform oxides were produced by lower oxalate precipitation temperatures, and the fraction of oversize particles decreased with increasing stirring rate and reagent addition rate. Nearly all the particles that sintered due to packing when fired to 1600°C for 4 hr were released by steeping and agitation in oxalic acid at pH 2.6. (auth)

11005 UCRL-5006

California. Univ., Livermore. Radiation Lab.

CRITICAL MEASUREMENTS ON INTERMEDIATE-ENERGY GRAPHITE-U^{235} SYSTEMS. J. E. Schwager, F. A. Kloverstrom, and W. S. Gilbert. Nov. 15, 1957. 40p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00 (mf OTS).

A system for the measurement of near-homogeneous carbon-U^{235} critical masses is described. Cores are constructed with thin, enriched-uranium foils spaced between graphite blocks. Fuel density is variable by use of different foil thicknesses and spacings. Reactivity is controlled by boron rods; standard reactor instrumentation permits critical operation at low power. Results of critical measurements on unreflected systems having atomic C/U^{235} ratios of 670, 1380, and 2590 are given. Thin reflectors of graphite and beryllium were also used. Corrections for self-shielding in the fuel foils and systematic errors are described. (auth)

11006 WAPD-PWR-CP-2649

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]

REMOVAL OF BORIC ACID FOLLOWING CHEMICAL SHUTDOWN OF PWR. C. S. Abrams. [Dec. 1956]. 2p. $1.80(ph OTS); $1.80(mf OTS).

A bench-scale test was run to determine the effectiveness of LiOH resin for removing boric acid following chemical shutdown of the PWR. (J.E.D.)

11007 WAPD-PWR-PMA-1517

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

PWR FAILED ELEMENT DETECTION AND LOCATION SYSTEM—MULTIPORT SAMPLING VALVE. Engineering Test Report, Equipment Specification 565285. M. L. Sloman. Jan. 29, 1958. 4p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

The specification tests and results are discussed including references to curves, and the conclusions drawn that the valve performed satisfactorily, after some modifications, in all respects except excessive leakages. These leakages were considered tolerable, however, because the effect on system operation is negligible. Development of a bellows to prevent leakage is underway. (J.R.D.)

11008 WAPD-PWR-PMM-674

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

OUTLINE OF PWR ALTERNATE CONTROL MATERIAL INFORMATION OBTAINED AT BETTIS. Jan. 15, 1957. 31p. [Contract AT-11-1-GEN-14.] $9.30 (ph OTS); $3.60(mf OTS).

Physics worth tests were completed on small coupon samples of stainless steel clad Cu-47 vol. % B_4^NC, Cu-50 vol. % B_4^NC, and Cu-57 vol. % B_4^NC prepared by roll bonding. Piston-cylinder wear tests were completed on Ag–Cd–In alloys in 550°F water at pH 9.5 to 10.5 with

LiOH. The data indicate that the alloys are showing satisfactory corrosion resistance in 500, 550, 600, and 650°F static, in 550°F high pH hydrogenated, in 650°F hydrogenated, and in 600°F dynamic neutral water. Curves are presented for the corrosion properties and calculated compositions of alloys before and after irradiation. (M.H.R.)

11009 WAPD-S5W-EP-45
Westinghouse Electric Corp. [Bettis Plant,] Pittsburgh.
SELF-SHIELDING EFFECTS AND THE CALIBRATION OF THE RMF. (S5W Applied Physics—WAPD-21 Program). C. P. Jamieson and P. B. Parks. Oct. 1956. 18p. Contract [AT-11-1-GEN-14]. $3.30 (ph OTS); $2.40(mf OTS).

The Reactivity Measurement Facility is described and drawings of its core and a sample capsule are given. Calibrations were carried out for three positions along the diagonal of the sample holder. The range of poison concentrations was from 0.0 to 2.0 cm^2 absorption cross section. The range of fuel concentrations was from 0.0 to 2.5 cm^2 fission cross section. Graphs of the reactor drift, U^{235} fuel calibration, and boron poison calibration are given. The reactivity worths of fuel and poison standards in the RMF are tabulated. (M.H.R.)

11010 WAPD-TH-426(Del.)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
MIXING IN RECTANGULAR NUCLEAR REACTOR CHANNELS. R. J. Slember. [1957?] 56p. $9.30 (ph OTS); $3.60(mf OTS).

Data on mixing by eddy diffusion in the wide direction of a rectangular channel were obtained under conditions of steady flow and for Reynolds' numbers in the range of 40,000 to 150,000. The test section consisted of a rectangular channel approximately ten ft long, four in. wide and a thickness which could be set at 0.1 or 0.2 in. The test procedure involved the measurement of the spread of a dye solution injected into the turbulent stream. The dye was introduced at various positions across the wide direction of the channel and samples were withdrawn downstream by a number of probes. The eddy diffusivity for mass was then determined from the measured concentrations of dye in the samples by comparing the test data with analytical solutions for the dye diffusion. These solutions were obtained treating the dye as diffusing from a finite rather than a point source. A series of normalized analytical curves presenting the solutions are included. It was found that the experimental values of eddy diffusivity could be correlated by the dimensionless expression $E/U_0 D_e = \Psi = 9 \times 10^{-3} (Re)^{-0.16}$ over the Reynolds Number range $3000 = Re = 100,000$, where Re is the channel Reynolds Number, E the centerline eddy diffusivity, U_0 the average channel velocity, and D_e the equivalent diameter. Additional studies on the general subject of flow and heat distribution under boiling as well as non-boiling conditions are planned. (auth)

11011 WAPD-TM-114
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
A LATTICE OF SLIGHTLY ENRICHED UO_2 FUEL RODS PARTLY IMMERSED IN LIGHT WATER. D. R. Harris. Nov. 1957. 26p. Contract AT-11-1-GEN-14. $1.00(OTS).

Few-group diffusion theory is employed to investigate the interaction between the water-moderated and dry portions of a lattice of slightly enriched UO_2 fuel rods, part of which is immersed in water. The theory is adapted to calculation of the variation of the interaction with the size of the lattice and with the position of the water surface in the lattice. The calculated variation of the interaction is in approximate agreement with reported measurements. An effectively infinite thickness of dry lattice is calculated to be at least 30 cm, about twice as thick as an effectively infinite water reflector. (auth)

11012 WKNL-106
Kidde (Walter) Nuclear Labs., Inc., Garden City, N. Y.
MAINTENANCE STUDIES FOR AN LMFR AND LMFRE. J. H. Frankfort and Philip Miller. Jan. 3, 1958. 138p. For Babcock and Wilcox Co. [Atomic Energy Div.] Subcontract AT(30-1)-1940-4. $25.80(ph OTS); $7.80 (mf OTS).

The results of an intensive study of the maintenance and handling problems of the Liquid Metal Fuel Reactor Experiment are given. One of the objectives of the LMFRE Project is to permit an evaluation of the feasibility and cost of maintaining a large nuclear power plant based on the LMFR concept. The study first investigated the remote maintenance problems of the LMFR and arrived at a recommended method for maintaining such a plant. This method was then incorporated in a maintenance program and design for the LMFRE. The conceptual design of the major equipment required for the recommended maintenance concept is dealt with. A program for development of this equipment is outlined, and the cost of carrying it out and of providing the equipment is estimated. Preliminary estimates of over-all maintenance costs are given. (W.D.M.)

11013 YAEC-33
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
STUDY TO DETERMINE ECONOMIC MAIN COOLANT SYSTEM PARAMETERS FOR YANKEE PROJECT. E. W. Ruppen. May 15, 1957. 70p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $10.80(ph OTS); $3.90(mf OTS).

Investigations which culminated in the selection of design parameters for the Yankee Power Reactor main cooling system are summarized. Parameters were optimized by assuming fixed core parameters and varying cooling system parameters, by varying core parameters and assuming fixed cooling system parameters, and by economic evaluations in terms of initial capital cost and annual fixed and operating cost. Selected parameters include a main system pressure of 2000 psia, steam generator outlet pressure of 500 psia, a core rating of 482 Mwh, and an electrical output rating of 145 Mwe. These selections reflect neither minimum initial or annual costs, but allow maximum improvements in operating efficiency with future developments in fuel technology. (D.E.B.)

11014 YAEC-64
Westinghouse Electric Co. Atomic Power Dept., Pittsburgh.
INSPECTION AND FABRICATION OF YAEC CRITICAL EXPERIMENT FUEL RODS. D. G. Brunstetter. Mar. 31, 1958. 71p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $10.80(ph OTS); $3.50(mf OTS).

The 5509 fuel rods for the Yankee Atomic Electric Company critical experiment were made by sealing sintered UO_2 pellets in stainless steel tubing by welding end plugs to each end of the steel tubes. The complete history of the fabrication of these fuel rods from the receipt of pellets to the radiographic inspection of the completed rods is discussed in detail. The control of the quality of the UO_2 powder was exercised by com-

paring certified analyses supplied by the vendor with analyses made by APD on corresponding lots. Chemical analyses, inspection data, procedures and processes are presented in tables and graphs. (auth)

11015

URANIUM–GRAPHITE REACTORS WITH SUPERHEATED STEAM FOR ELECTRIC POWER STATIONS. N. A. Dollezhal'. Atomnaya Energiya 3, 391-7(1957). (In Russian)

A graphite moderated and reflected power reactor, using superheated steam as a heat exchanger, is described. The reasons for using superheated steam as a heat exchanger are discussed. The basic characteristics of the atomic power system are given. (J.S.R.)

11016

THE EFFECTIVE OUTPUT OF ATOMIC ENERGY STATIONS. I. I. Novikov. Atomnaya Energiya 3, 409-12(1957). (In Russian)

From formulas derived for the efficiency of atomic power stations, it is shown that when the temperature of the fuel elements is increased the temperature of the working fluid and the effective efficiency of the station increase. The temperature of the working fluid increases rather slowly, but the effective efficiency increases rapidly. When the reactor temperature is increased to twice its initial value, the temperature of the working fluid increases 40% while the efficiency is almost doubled. (J.S.R.)

11017

THE FRENCH DUAL-PURPOSE REACTORS G-2 AND G-3. K. Yu. Atomnaya Energiya 3, 560-1(1957).

The published data on the reactor, cooling system, steam generation, turbines, generator, energy transmission, and storage and purification of CO_2 are compiled. (J.S.R.)

11018

REGENERATIVE HEATING OF THE WATER IN A WATER-COOLED POWER REACTOR. I. A. Trub. Atomnaya Energiya 4, 286-9(1958) Mar. (In Russian)

11019

THE ACCIDENT AT WINDSCALE AND THE RADIATION DAMAGE TO GRAPHITE. G. Gandusio and S. Polezzo (ENI, Milan). Energia nucleare (Milan) 5, 289-96(1958) May. (In Italian)

The causes and effects of the Windscale accident are discussed. The problems resulting from such an accident are reviewed with special attention to the Wigner release and the structural modifications of graphite caused by the irradiation. (J.S.R.)

11020

CALCULATIONS OF THE DIMENSIONS, EFFICIENCY, AND NEUTRON FLUX FOR CYLINDRICAL GRAPHITE REACTORS WHICH ARE COMPLETELY SURROUNDED BY A GRAPHITE REFLECTOR. Lennart Simons. Fysikersamfundet i Finland No. 32. 32p. (1958). (In Swedish)

11021

FUTURE ENGINEERING DEVELOPMENT OF THE GAS-COOLED NUCLEAR REACTOR. J. M. Kay (Imperial Coll., London). J. Brit. Nuclear Energy Conf. 3, 96-100(1958) Apr.

A review of the basic technology of the gas-cooled graphite-moderated reactor of the Calder Hall type is presented. It is shown that the present commercial power-producing reactor designs are based on the use of a larger size core, higher average heat rating in Mw per ton of fuel, longer irradiation, and slightly higher temperatures. The range of development, using materials similar to those employed at Calder Hall, is discussed in some detail. Finally, the implications of changes in materials and in basic reactor technology are analyzed. (auth)

11022

COMMISSIONING AND OPERATION OF 'A' STATION, CALDER WORKS. H. G. Davey (U.K.A.E.A., Industrial Group, Windscale Works, Cumberland, Eng.). J. Brit. Nuclear Energy Conf. 3, 101-8(1958) Apr.

The commissioning and operation of "A" station, Calder Works consisting of reactors one and two are discussed. Just the reactor and its associated equipment are considered. Particulars are given of the loading of fuel, the measurement of lattice constants, and the installation and calibration of control rods. A brief description of plant tests and the work done to make the plant operative is given. (W.D.M.)

11023

OPERATIONAL EXPERIENCE AT CALDER HALL. K. L. Stretch. J. Brit. Nuclear Energy Conf. 3, 109-15(1958) Apr.

The program carried out to commission and operate the Calder Hall nuclear power station from the time when reactor No. 1 was taken over by the operations branch in May 1956, until the complete unit was on line at full power is described. The relevance of the tests and their results to the successful operation of the Calder Hall project, in particular and the prospects for nuclear generation of power in general, is considered. (W.D.M.)

11024

SOME SAFETY CONSIDERATIONS OF NUCLEAR POWER REACTORS. C. D. Boadle (Rolls Royce, Ltd., Derby, Eng.). J. Joint Panel Nuclear Marine Propulsion No. 1, 5-27(1957) Apr.

Nuclear reactors exhibit many characteristics which are quite unlike those of other power producers. Some provide valuable self-regulating features in a reactor, while others provide the means of rapid power surges capable of causing serious damage, unless controlled by a control and monitoring system provided for the purpose. For many types of reactor, the final guarantee that radioactive materials will not be discharged following an accident must be provided by complete containment in a gas tight building or pressure shell. In conclusion, some of the aspects of more advanced systems now being considered in various parts of the world are discussed, together with the improvements in inherent reactor safety likely to accrue from these new ideas. (auth)

11025

REACTOR TEST LOOPS. 1. INTRODUCTION. I. Everson.(Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 3, 260-5(1958) June.

The part reactor test loops play in reactor development is discussed in terms of design, safety circuitry, construction, installation, and operation. Descriptions of the different kinds of loops are given. (W.D.M.)

11026

CERAMIC PASTES FOR ATOMIC REACTORS. Jan Hlavac. Sklář a keram. 6, No. 4, 87-90(1956). (Translated from Referat. Zhur. Khim. No. 2, 1957, Abstract No. 5222.)

11027

THE THEORY OF THERMAL NEUTRON NUCLEAR REACTORS. PART 2. A. D. Galanin. Soviet J. Atomic Energy (English Translation) Suppl. No. 2-3, 189-291 (1958).

In this second part of the book there is no systematic presentation of theory. It contains individual problems of the theory which appear as supplements to sections in the first part of the book. The problems discussed include one-velocity kinetic equations, approximate solutions for the kinetic equation, nondiffusion corrections to the thermal utilization coefficient, neutron spectrum at thermal energies, resonance absorption in a homogeneous medium with a nonhydrogenous moderator, resonance absorption of a block with a moderator, critical dimensions for a reflected reactor in two-group theory, numerical calculations for critical reactor dimensions, theory of the heterogeneous reactor, minimum critical mass and neutron distribution in a reactor, and neutron density gradient near a control rod. (J.S.R.)

11028

THE THEORY OF THERMAL NEUTRON NUCLEAR REACTORS. PART 1. A. D. Galanin. Soviet J. Atomic Energy (English Translation) Suppl. No. 2-3, 1-187 (1958).

In the first part of the book a systematic presentation of the theory of thermal reactors is given. The contents include diffusion and slowing-down of neutrons; critical reactor dimensions from one-group theory; multiplication, slowing-down, and diffusion of neutrons in a uniform medium; the heterogeneous reactor; critical reactor dimensions; perturbation theory; time behavior of the isotopic composition of nuclear fuel; and kinetics with delayed neutrons, temperature coefficient, and control. As the book is intended to serve as a handbook for neutron calculations in reactors, other parts of reactor theory, such as heat exchange and shielding, are not considered. (J.S.R.)

11029

BUILDING A NUCLEAR POWER STATION. Special Suppl. to British Engineering International. 18p. (1958) May.

The plant and equipment which have been installed at the Berkeley Nuclear Power Station are described. The Berkeley Station is taken as an example of the latest developments in the graphite-moderated, gas-cooled reactors for electricity generation; and the equipment described and illustrated is of the kind which could be supplied to a station of this type anywhere in the world. (W.D.M.)

11030

BLENDING VS. REENRICHMENT FOR SLIGHTLY ENRICHED URANIUM. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 2, Session 18. Donald Kallman and John E. Brennan (Babcock and Wilcox Co.). New York, American Institute of Chemical Engineers, 1958. 11p.

The economic aspects of blending irradiated fuels with highly enriched uranium and the reenrichment of irradiated, but decontaminated, uranium to obtain slightly enriched uranium fuels are considered. It is concluded that blending with highly enriched uranium may be permanently practiced in place of reenrichment at the diffusion plant because the difference in cost may be small and the flexibility greater. (J.S.R.)

11031

CERMET CONTROL-ROD FABRICATION BY POWDER ROLLING. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 16, Session 18. Samuel Storchheim (Metals Research and Development, Inc., Exeter, Penna.). New York, American Institute of Chemical Engineers, 1958. 13p.

Many difficulties encountered during the fabrication of control rods made of B_4C in stainless steel, Eu_2O_3 in stainless steel, and B_4C in aluminum are avoided by use of a new fabrication technique, namely, rolling powder mixtures into strip. This process is discussed and illustrated. Simultaneous cladding of control cores with protective alloys is also touched upon. (auth)

11032

CONSIDERATIONS IN THE DESIGN OF THE NUCLEAR SAFETY INSTRUMENTATION SYSTEM FOR THE ENRICO FERMI ATOMIC POWER PLANT. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 42, Session 21. V. S. Underkoffler and R. G. Olson (Leeds and Northrup Co., Philadelphia and Atomic Power Development Associates, Inc., Detroit). New York, American Institute of Chemical Engineers, 1958. 21p.

The conceptual design of the nuclear safety instrumentation system for a central station nuclear power plant provides considerable insight into the complexity of the instrumentation requirements for such a system. The proposed safety instrumentation system for the Enrico Fermi Atomic Power Plant is used as an illustration of this complexity. Emphasis is placed on the safety instrumentation and its associated equipment. The design is traced through its many aspects, and the problems encountered are indicated. The supporting experimental and simulation programs are briefly discussed to further illustrate the vast amount of information required for the conceptual design. (auth)

11033

AN ELECTRONIC FEEDWATER CONTROL SYSTEM FOR THE EXPERIMENTAL BOILING WATER REACTOR. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 36, Session 17. R. H. Morse and R. N. Brey, Jr. (Leeds and Northrup Co., Philadelphia). New York, American Institute of Chemical Engineers, 1958. 15p.

The Electronic Feedwater Control System (3 element) for the EBWR is described. A general description of the installation is given with block diagrams of the control arrangement. Circuitry details are covered in simplified schematic diagrams of the Control Unit, Bridge and Mixer and other elements. The versatility of this system as applied to an Experimental Project is described in detail. (auth)

11034

INSTRUMENTATION FOR A BOILING WATER REACTOR. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 32, Session 21. Lester Kornblith, Jr. (General Electric Co.). New York, American Institute of Chemical Engineers, 1958. 11p.

The instrumentation of the General Electric Developmental Boiling Water Reactor is described. This reactor is a small-scale power reactor supplying steam to a turbine operated by Pacific Gas and Electric Company as part of their generating facilities. An attempt has been made in the design of the plant to keep the instrumentation as simple as possible consistent with safety, operability, and the requirements for developmental facilities. The discussion includes both the nuclear and steam sections of the instrumentation. (auth)

11035

LMFR BREEDER BLANKET PREPARATION BY FUSION ELECTROLYSIS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 43, Session 18. M. E. Sibert, A. L. Cunningham, and M. A. Steinberg

(Horizons, Inc., Cleveland). New York, American Institute of Chemical Engineers, 1958. 33p.

A program was carried out to scale up and demonstrate reproducibility of an electrolytic process for preparation of uniform equiaxed particle dispersions of Th bismuthide in Bi for possible use as a liquid metal reactor breeder blanket. $ThCl_4$ is subjected to electrolysis in an alkali-alkaline earth chloride melt utilizing a liquid Bi cathode. Conditions of electrolysis and requirements of the process are described which yield dispersions containing up to 10 w/o or more Th as Th bismuthide. Dispersions are uniform and contain equiaxed particles suitable for use in a flowing metal system. (auth)

11036

A NEW METHOD FOR THE MEASUREMENT OF GASES IN HIGH PRESSURE WATER REACTOR PLANTS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 34, Session 17. Frank C. Steiner (Knolls Atomic Power Lab., Schenectady, N. Y.). New York, American Institute of Chemical Engineers, 1958. 14p.

A simple and rapid method for determining total dissolved gas and hydrogen concentrations in the coolant of pressurized water systems is described. The application is suitable to shipboard use and gives results in 5-10 minutes that agree well with lengthy laboratory methods. (auth)

11037

NUCLEAR SAFETY CONSIDERATIONS IN THE HANDLING AND STORAGE OF REACTOR FUELS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 29, Session 32. Norman Ketzlach (General Electric Co., Richland, Wash.). New York, American Institute of Chemical Engineers, 1958. 23p.

Methods of calculation to determine design criteria for nuclear safety specifications in the handling and storage of slightly enriched fuels are presented. Examples for fuel elements of 1.60% and approximately 90% U-235 enrichment are given. The importance of understanding the reactor theory involved in interpreting results of calculation so that they can safely be applied to plant process conditions cannot be overemphasized. The importance of standardization of transportation specifications for shipping large quantities of these fuels is also indicated. (auth)

11038

PHYSICAL FACTORS IN THE GAINESVILLE, FLORIDA, AREA AFFECTING SITE LOCATION OF A ONE MEGAWATT NUCLEAR RESEARCH REACTOR. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 15, Session 19. Stanley O. Reichert (Univ. of Florida, Gainesville). New York, American Institute of Chemical Engineers, 1958. 35p.

• The topographic, geologic, hydrologic, industrial, agricultural, and population density factors present in the greater Gainesville area are described and illustrated in sufficient detail to provide an accurate picture of the site and surroundings for a one-megawatt research reactor. This research reactor should not be confused with the 10 kilowatt training reactor to be built near the Engineering and Industries Building. Next, the consequences of the accidental release of radioactivity from the reactor to the ground surrounding the reactor are considered in detail. It is concluded that in order to reduce to an absolute minimum the remote possibility of discharge of radioactive liquid to the ground, containment must be provided. This conclusion is equally valid regardless of the location chosen in this general area for the reactor. There are several areas outside of the main campus of the University where there are safety advantages over a reactor site located on the main campus. These other areas are also evaluated in detail. These natural safety advantages of off-campus sites must be balanced with many other factors beyond the scope of this report before a final best location can be selected. (auth)

11039

RADIOLYTIC AND PYROLYTIC DECOMPOSITION OF ORGANIC REACTOR COOLANTS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 23, Session 8. D. R. de Halas (General Electric Co., Richland, Wash.). New York, American Institute of Chemical Engineers, 1958. 20p.

A rate law has been derived for the combination of radiolytic and pyrolytic damage to organic coolants in a dynamic system. This law is based on observations of the radiolytic damage in the test loop, and the behavior of the radiolytic tars towards heat. The application of this law provides a simple method of determining the maximum utilizable temperature for an organic coolant. (auth)

11040

SOME ASPECTS OF THE USE OF AN ORGANIC COOLANT IN A HEAVY-WATER MODERATED POWER REACTOR. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 20, Session 8. Malcolm J. McNelly (General Electric, Peterborough, Ontario, Can.). New York, American Institute of Chemical Engineers, 1958. 35p.

Organic materials have been assessed as a possible replacement for the heavy water coolant in a natural uranium fueled, heavy water moderated power reactor. These materials appear to provide scope for appreciable cost reduction in this reactor system. Some of the major considerations on which such an application of an organic heat transfer fluid is based are presented. (auth)

11041

THERMAL CONSIDERATIONS IN THE DESIGN OF CONCRETE STRUCTURES FOR SHIELDING ATOMIC POWER PLANTS. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 9, Session 36. Harold S. Davis (General Electric Co., Richland, Wash.). New York, American Institute of Chemical Engineers, 1958. 35p.

The sources of heat are considered; namely: (1) internal heat generation in a concrete shield produced by the attenuation of neutrons and gamma radiation, and (2) heat transfer to the concrete from hotter components of the atomic reactor. Design criteria are presented and evaluated, including heat rates and allowable values of temperature. Methods for determining the temperature distribution through a concrete shield and thermal stresses produced by the above heat sources are discussed. In a general way, the present status of shield design is reviewed and areas indicated where additional information and research are required. (auth)

11042

VARIATION OF THE TRIP POINT IN THE ORNL TYPE SAFETY SYSTEM. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 41, Session 29. J. L. Cockrell and C. W. Ricker (Leeds and Northrup Co., Philadelphia and

Univ. of Michigan, Ann Arbor). New York, American Institute of Chemical Engineers, 1958. 10p.

In nuclear reactor safety systems electromagnets are often used to connect neutron absorbing rods to positioning drive units. The currents through these electromagnets can be varied in a continuous or discontinuous manner as a function of the reactor neutron level, the ultimate objective being to enable a trip or scram should an unsafe operating condition be present or imminent. A group of instrument channels, interconnected so as to determine whether the "unsafe operating condition" exists and, upon such determination, to trip the rods (all with no operator attention), comprise a safety system. One such safety system is the so-called "auctioneering" array of safety amplifiers, all deriving information from separate channels, and jointly feeding a single common point of interconnection or bus. The state of this bus is determined by the highest bidder, (the channel with the highest output voltage). Thus a single channel, detecting an unsafe condition, is able to assume control and eventually shut down the system. The functioning of the individual channels, their inputs, and the interaction of a group of these channels, must be known so that due consideration may be given in setting up the equipment to cause trip to occur under the proper conditions. It is the objective of this report to supplement the understanding of single channel performance by presenting the significant aspects of system performance. (auth)

Nuclear Transformation

11043 AECU-3514

Michigan. Univ., Ann Arbor.

NUCLEAR DECAY SCHEME ANALYSIS AND CHARACTERIZATION STUDIES OF (d,α) REACTION PRODUCTS. Donald Glenn Gardner. May 15, 1957. 248p. Project No. 7. Contract AT(11-1)-70. $5.50 (OTS).

A study was made to assess the value of a fluorescent plastic detector for use in beta ray spectroscopy. This led to the design, construction, and evaluation of a hollow-type scintillation beta ray spectrometer. The performance of the device was evaluated. A new method of solution for the analysis of complex radioactive decay curves is proposed. Characterization studies were made of the isotopes Co^{62}, Y^{92}, Ir^{196}, and Sc^{47} which were produced by the (d,α) reaction in cyclotron-bombarded targets. Chemical separations were required in all cases, and carrier-free procedures were developed for cobalt, yttrium, and scandium. New decay schemes are proposed for Co^{62} and Y^{92}. The previous assignment of an 8 day activity of iridium to Ir^{196} is shown to be incorrect, the activity being due to Ir^{189} and Ir^{190}. New gamma ray information is given for Ir^{189} and Ir^{190}, together with excitation functions for the (d,α) reaction on Pt^{194} and Pt^{196} for deuteron energies at 9.6 to 20.8 Mev. The gamma ray information obtained from the scandium work verifies the data reported recently by others. (W.D.M.)

11044 CU-173

Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. Pegram Lab.

A CRITICAL EXAMINATION OF THE He^6 RECOIL EXPERIMENT OF RUSTAD AND RUBY. C. S. Wu and A. Schwarzschild. Apr. 21, 1958. 17p. Contract AT-30-1-GEN-72. $3.30(ph OTS); $2.40(mf OTS).

The He^6 experiment was investigated to decide whether any systematic errors due to oversight could have affected their interpretation, which indicates tensor interaction. It is concluded that some corrections which the authors neglected in their calculations were substantial enough to make their conclusion questionable. A precise correction of the measured coincidence results was found to be impossible due to the semitransparency and multiple scattering effect of the diaphragm holes. (M.H.R.)

11045

INVESTIGATION OF THE γ-RAYS EMITTED BY THE NUCLEI OF V, Mn, Co, AND Al ON THE OCCASION OF THE CAPTURE OF THERMAL NEUTRONS. L. V. Groshev, A. M. Demidov, V. N. Lutsenko, and V. I. Pelekhov. Atomnaya Energiya 3, 187-203(1957).

The energies of the gamma radiation emitted in the reactions $V^{51}(n,\gamma)V^{52}$, $Mn^{55}(n,\gamma)Mn^{56}$, $Co^{59}(n,\gamma)Co^{60}$, and $Al^{27}(n,\gamma)Al^{28}$ were measured with a scintillation spectrometer. The energy levels of the final nuclei are tabulated. (J.S.R.)

11046

THE Li(p,n)Be REACTION AND THE FUNDAMENTAL STRUCTURE OF THE Be^8 NUCLEUS. G. F. Bogdanov, N. A. Vlasov, S. P. Kalinin, B. V. Rybakov, and V. A. Sidorov. Atomnaya Energiya 3, 204-10(1957).

By means of the time of flight method the neutron spectra from the reactions $Li^6(p,n)Be^6$ and $Li^7(p,n)Be^7$ were measured. The neutron distribution and the reaction cross sections were also determined. For the Li^6 reaction $Q_0 = 5.2 \pm 0.2$ Mev. The width of the ground state was $\Gamma < 0.3$ Mev. The angular distribution of neutrons was $\sigma(\theta) = 0.19 + 0.23\cos(\theta) + 0.70\cos^2(\theta)$ mb/steradian. The mass defect of Be^8 was $20.3 < 0.2$ Mev, and the reaction cross section for the ground state at a proton energy of 9 Mev was $\sigma = 5 \pm 1$ mb. For the Li^7 reaction the neutrons corresponding to the ground state, the 0.43 Mev level, and the 4.65 Mev level was found. The angular distribution of the neutrons of the ground state and the first level was $\sigma(\theta) = 6.8 + 2.4\cos^2(\theta)$ mb/steradian. The total reaction cross section for the formation of the ground state and the first level at a proton energy of 9 Mev was $\sigma = 100 \pm 20$ mb. Neutrons were also observed from the $Li^6(p,pn)Li^5$ and $Li^6(p,2pn)He^4$ reactions. (J.S.R.)

11047

THREE BODY BREAK UP. T. H. Berlin and George E. Owen (Johns Hopkins Univ., Baltimore). Nuclear Phys. 5, 669-76(1958).

The continuous phase space distribution function is evaluated for (n,2n) processes. The constraints of energy and momentum conservation are imposed in the form of delta functions. To facilitate transformation of the distribution function from the center of mass coordinates to the laboratory coordinates, a general form of the Jacobian is developed. The $Be^9(n,2n)Be^8$ reaction is considered as an example. (auth)

11048

DEUTERON PRODUCTION BY NUCLEONS BOMBARDING ATOMIC NUCLEI. Ken Kikuchi (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 18, 503-40(1957) Nov.

Deuteron production by nucleon bombardment is discussed in detail. According to the general theory of nuclear reactions developed by Ui, the transition matrix is written as the sum of two elements, which corresponds to the compound and the noncompound nuclear processes. In the processes proceeding through the compound nucleus, the indirect pickup process, in which a neutron emerging from the compound nucleus picks up

any proton, gives a larger yield than the deuteron evaporation in the usual sense. The average kinetic energy of deuterons thus produced is about three times larger than that in the Maxwellian type. In the direct pickup process of low energy (p,d) reaction, the Coulomb effect is found to play an important role and the remarkable backward maximum in the angular distribution of the reaction product is predicted. Direct pickup process at moderate and high energies is calculated by the Born approximation, assuming the Gaussian momentum distribution for the tail of the wave function of the nucleon to be picked up. The forward peak in the angular distribution for sharp energy deuteron groups corresponding to the ground state and the low-lying levels is interpreted in terms of the direct process taking place in the external region of the target nucleus. In the limiting case of the weak coupling, which is an appropriate approach to the high energy reaction, the calculation is performed using the Chew-Goldberger's procedure on the basis of the non-degenerate Fermi gas model, and the total cross section is found to obey approximately 1/v law. Further the production cross section of ^{1}s deuterons is evaluated in the same way, and is found to give a contribution comparable to the production of deuterons in the ground state. (auth)

11049

THE STRIPPING PROCESS IN THE INTERACTIONS OF ACCELERATED N^{14} IONS WITH THE NUCLEI OF SOME ELEMENTS. V. V. Volkov, A. S. Pasyuk, and G. N. Flerov (Academy of Sciences, USSR). Soviet Phys. JETP 6, 459-63(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3325.

11050

THE ROLE OF NUCLEONS IN MULTIPLE PRODUCTION OF PARTICLES. A. A. Emel'ianov and I. L. Rozental' (P. N. Lebedev Physics Inst., Academy of Sciences, USSR). Soviet Phys. JETP 6, 622-3(1958) Mar.

To determine the role of nucleons in the multiple production of particles, a simplified model of the hydrodynamical development of the system is considered. The case of a collision of two nucleons is studied. The fraction of the energy of the system carried by the fast nucleon is determined. It is shown that the energy of the nucleon $E_k \cong 0.6\ E_0$, where E_0 is the energy of the incident nucleon. Also, the energy of the fast nucleon depends appreciably on the value of the volume V of the interacting system, $E_k \sim V^{-0.4}$. (J.S.R.)

11051

POLARIZATION MEASUREMENTS ON d-D AND d-T NEUTRONS. Pieter Jelte Pasma. 'S-Gravenhage, Excelsior, [1957]. 91p.

Polarization measurements on neutrons generated by low-energy deuterons according to the reactions $D(d,n)He^3$ and $T(d,n)He^4$ are reported. The d-D neutron polarization experiments cover the hitherto little-investigated deuteron energy region of 200 to 500 kev. For the d-T neutrons, the deuteron bombarding energy was varied from 100 to 300 kev. The elastic scattering from He^4 has been used throughout as a polarization analyzer. Some theoretical considerations on polarization are summarized. A description of the neutron generator and gas scintillation counter is given. The experiments were performed with a coincidence technique. (W.D.M.)

Particle Accelerators

11052 AECU-3707

Minnesota. Univ., Minneapolis. Linear Accelerator Lab.

ANNUAL PROGRESS REPORT FOR YEAR ENDING MARCH 1958. 125p. Contract AT(11-1)-50. (M-6499). $19.80(ph OTS); $6.30(mf OTS).

Results are presented from experiments on a variety of nuclear processes which were performed with the linear accelerator. Theoretical studies and calculations are included. Developments of the accelerator which enhance its usefulness as a research tool are reported. Progress is reported in studies on proton-proton scattering at various energies; proton nucleus elastic scattering from carbon, copper, iron, lead, lithium, nickel, nitrogen, silver, tantalum, and zinc; proton-nucleus reactions; neutron spectra and total cross section measurements; instrument and electronics developments; optical model studies; development of an approximation method and computational program for studies on the scattering of protons in a spin orbit potential; angular correlations in (p,2p) reactions; and nuclear structure studies on two body forces in the 1S shell and the H^3-He^3 mass difference and the states of He^4. Fluorine^{18} was produced from O^{18} enriched water bombarded by 10-Mev protons. Tracer studies on the metabolism of fluorine in dogs are reported. A list is included of publications and theses completed during the period. (C.H.)

11053 AECU-3709

Cambridge Electron Accelerator, Mass.

THE CAMBRIDGE ELECTRON ACCELERATOR. M. Stanley Livingston. May 4, 1956. 17p. Contract [AT(30-1)-1909]. (CEA-1(M-H)). $3.30(ph OTS); $2.40(mf OTS).

A general account is given of the plans for the 6-Bev electron synchrotron to be built by Harvard University and M.I.T. with the support of the Atomic Energy Commission. The accelerator ring will include 48 strong-focusing magnets, each with a positive-gradient section and a negative-gradient section. The 48 megnets will be spaced by 48 field-free straight sections, 16 of which will contain r-f accelerating cavities. Electrons of 20-Mev energy will be injected from a linac. The peak field to give 6.0-Bev electrons is 7600 gauss; the magnet will be excited by a resonant power supply at 30 cps with d-c bias to give unidirectional pulsing. (auth)

11054 AECU-3710

Cambridge Electron Accelerator, Mass.

REVISED PARAMETERS FOR 7.5 BEV. M. Stanley Livingston. May 24, 1956. 7p. Contract [AT(30-1)-1909]. (CEA-2(M-H)). $1.80(ph OTS); $1.80(mf OTS).

A list is given of the required parameter values to accelerate electrons to 7.5 Bev in the Cambridge Electron Accelerator. Although the present goal is a 6.0-Bev synchrotron, the design will be such as to provide the possibility of such modifications as will be necessary to reach higher energies. (auth)

11055 AECU-3711

Cambridge Electron Accelerator, Mass.

CONTROL OF OSCILLATION AMPLITUDES. Kenneth W. Robinson. May 15, 1956. 13p. Contract [AT(30-1)-1909]. (CEA-4(M-H)). $3.30(ph OTS); $2.40(mf OTS).

Methods of correcting for the anti-damping of the radial betatron oscillations are analyzed. Practical

methods of reducing the anti-damping are to couple the radial and vertical betatron oscillations by means of a rotated magnetic quadrupole lens, or to add a magnetic structure which has a decrease in radiation loss for increasing radius of particles. It is shown that the damping ratio cannot be changed by shaping the r-f cavities. (auth)

11056 AECU-3712
Cambridge Electron Accelerator, Mass.
RADIOFREQUENCY ACCELERATION II. Kenneth W. Robinson. Sept. 10, 1956. 19p. Contract [AT(30-1)-1909]. (CEA-11(M-H)). $3.30(ph OTS); $2.40(mf OTS).

A radiofrequency system consisting of 16 cavities, strongly coupled together by transmission line, is analyzed. This system can be regarded as a single cavity operating in a particular mode, and is found to be a practical system for the accelerator. Also methods of coupling r-f power into the system are considered. The r-f system with beam loading is analyzed for stability, and a relationship determined for the range of the cavity tuning over which the system is stable. (auth)

11057 AECU-3713
Cambridge Electron Accelerator, Mass.
INJECTION I. Allan Lichtenberg and Kenneth W. Robinson. Oct. 23, 1956. 12p. Contract [AT(30-1)-1909]. (CEA-13(M-H)). $3.30(ph OTS); $2.40(mf OTS).

The fraction of injected electrons which will be captured and accelerated to high energy is calculated approximately considering energy spread, angular divergence, and spot size of the linac. It is found that with a perfect magnet the maximum possible acceptance is about 25% with no phase prebunching and about 50% with perfect phase bunching. Methods of reducing the energy and phase spread from the linac are considered. (auth)

11058 AECU-3714
Cambridge Electron Accelerator, Mass.
ELECTRON RADIATION AT 6 BEV. Kenneth W. Robinson. Oct. 23, 1956. 3p. Contract [AT(30-1)-1909]. (CEA-14(M-H)). $1.80(ph OTS); $1.80(mf OTS).

The characteristics of the electromagnetic energy radiated by the electrons are calculated for the parameters of the Cambridge Electron Accelerator. Also the radiated power obtainable for experimental purposes by a tangential beam pipe is calculated. (auth)

11059 AECU-3715
Cambridge Electron Accelerator, Mass.
MAGNET PARAMETERS FOR 6.0 BEV. M. Stanley Livingston. Nov. 9, 1956. 5p. Contract [AT(30-1)-1909]. (CEA-15(M-H)). $1.80(ph OTS); $1.80(mf OTS).

A detailed list of magnet parameters is given. Included are requirements for various components: magnet core, excitation coils, and power supply, all for operation at 6.0 Bev. (auth)

11060 AECU-3716
Cambridge Electron Accelerator, Mass.
MAGNET POWER SUPPLY ANALYSIS. M. Stanley Livingston. Nov. 9, 1956. 11p. Contract [AT(30-1)-1909]. (CEA-16(M-H)). $3.30(ph OTS); $2.40(mf OTS).

An analysis of the power supply requirements of the 6.0-Bev synchrotron magnet was made. Details of the requirements of the system, including the ring storage choke, are given. The cost is estimated. (auth)

11061 AECU-3717
Cambridge Electron Accelerator, Mass.
RADIOFREQUENCY PARAMETERS. Kenneth W. Robinson. Nov. 21, 1956. 5p. Contract [AT(30-1)-1909]. (CEA-17(M-H)). $1.80(ph OTS); $1.80(mf OTS).

Numerical values of the parameters of the radiofrequency accelerating system are calculated. (auth)

11062 AECU-3718
Cambridge Electron Accelerator, Mass.
EFFECT OF R.F. SYSTEM ON BETATRON OSCILLATIONS. Kenneth W. Robinson. Nov. 28, 1956. 7p. Contract [AT(30-1)-1909]. (CEA-18(M-H)). $1.80 (ph OTS); $1.80(mf OTS).

The change in betatron frequency due to the focusing action of the radiofrequency cavities is calculated. It is found that at injection the fractional change in radial betatron frequency for particles with small phase oscillations is given by $-0.025V$, where V is the maximum r-f voltage per turn in Mev. There is an equal and opposite change in the vertical betatron frequency. Also it is proven, in a general manner, that the damping rate of the betatron oscillations is independent of the nature of the radiofrequency system. (auth)

11063 AECU-3719
Cambridge Electron Accelerator, Mass.
PROGRAM FOR MAGNETIC MEASUREMENTS. M. Stanley Livingston. Jan. 7, 1957. 18p. Contract [AT(30-1)-1909]. (CEA-19(M-H)). $3.30(ph OTS); $2.40(mf OTS).

Plans for measurements on magnet models are analyzed and the special purposes reviewed, in order to specify the degree of precision required for the application of model studies to the accelerator magnet design. In order to save time and effort, no model measurement should be much more precise than is required to arrive at machine specifications. (auth)

11064 AECU-3720
Cambridge Electron Accelerator, Mass.
VARIABLE-FREQUENCY MAGNET POWER SUPPLY. M. Stanley Livingston. Jan. 21, 1957. 7p. Contract [AT(30-1)-1909]. (CEA-20(M-H)). $1.80(ph OTS); $1.80(mf OTS).

The possibility of designing a variable-frequency power supply for the magnet of the 6.0-Bev electron synchrotron is examined. The advantages and technical features of such a supply are considered, and the accelerator performance at different frequencies is predicted. Circuit parameters for several frequencies are listed. The present plan providing for 6-Bev electron energy and a pulse frequency of 30/sec offers the best combination of energy and intensity within the budgetary limitations; if the power supply can be designed to provide variable frequencies, flexible operation will be possible, with different energies and intensities at different frequencies. (auth)

11065 AECU-3721
Cambridge Electron Accelerator, Mass.
PHASE PRE-BUNCHING. Allan J. Lichtenberg. Feb. 19, 1957. 18p. Contract [AT(30-1)-1909]. (CEA-21(M-H)). $3.30(ph OTS); $2.40(mf OTS).

The use of a pre-buncher to decrease the spread in phase of the beam emerging from the linac is examined. Such pre-bunching could bring a much larger proportion of the linac beam within the acceptance limits of the synchrotron. With the linac frequency n times the synchrotron frequency, the output of the linac, without prebunching, would consist of n particle pulses spaced over the synchrotron cycle. By using a pre-buncher operated at the synchrotron frequency, it is possible to concentrate most of the charge into one of these n linac pulses, thus giving an effective linac output of one very narrow phase bunch per synchrotron cycle. (auth)

11066 AECU-3722
Cambridge Electron Accelerator, Mass.
REDUCTION OF ENERGY SPREAD AT THE OUTPUT OF A LINAC. Allan J. Lichtenberg. Feb. 19, 1957.

15p. Contract [AT(30-1)-1909]. (CEA-22(M-H)). $3.30(ph OTS); $2.40(mf OTS).

The problem of reducing the energy spread among the particles accelerated by a linear accelerator is examined theoretically, with particular emphasis on electron linacs. (auth)

11067 AECU-3723
Cambridge Electron Accelerator, Mass.
HIGH-FIELD AND FLUX MEASUREMENTS ON THE HYBRID MARK II MAGNET. Janez Dekleva and John Rees. Feb. 27, 1957. 20p. Contract [AT(30-1)-1909]. (CEA-23(M-H)). $3.30(ph OTS); $2.40(mf OTS).

The results of comparative magnet field measurements on identical electromagnets made of four different steels (U. S. Steel Transformer 72 and Transformer 52 and Allegheny Ludlum Transformer Grace C and Silectron) are presented. Particular attention is directed to the high-field (~9.5 kilogauss) characteristics. Also measurements of the flux distributions of the C.E.A. model magnets powered by a-c are described and extrapolations are made to the accelerator magnets. (auth)

11068 AECU-3724
Cambridge Electron Accelerator, Mass.
USE OF RECTIFIER IN MAGNET POWER CIRCUIT. M. Stanley Livingston and Kenneth W. Robinson. Mar. 13, 1957. 7p. Contract [AT(30-1)-1909]. (CEA-24(M-H)). $1.80(ph OTS); $1.80(mf OTS).

The effect of rectifiers in series with the magnets is analyzed. It is found that the magnet power circuit may be excited with a-c power and a rectifier will provide the d-c power for half-bias operation. The rectifier will automatically insure $dB/dt = 0$ at the beginning of the acceleration cycle, independent of small fluctuations in the a-c power supply. The peak voltage across the rectifiers is found to be 1.5 kv per magnet sector. (auth)

11069 AECU-3725
Cambridge Electron Accelerator, Mass.
ON THE EXISTENCE OF A MAGNETIC AND FOCUSING LENGTH IN A SYNCHROTRON. J. Dekleva and G. Lanza. Apr. 1, 1957. 6p. Contract [AT 30-1 - 1909]. (CEA-26(M-H)). $1.80(ph OTS); $1.80(mf OTS).

Measurements of B and n values indicate the existence of two different effective lengths in the azimuthal direction. They are called equivalent magnetic length $L_B = (\int Bds/B_0)$ and equivalent focusing length $L_F = (\int nds/n_0)$ ($L_F < L_B$), respectively. It is demonstrated that the first one is the length to be used for the calculation of the radius and the second one in the calculation of the field gradient values. The formulas for the structure of the Cambridge Electron Accelerator are derived on this basis and the error arising in the betatron wavelength from the replacement of L_B by L_F is estimated. For $L_B - L_F \sim 1''$ it is found that the error is negligible. (auth)

11070 AECU-3726
Cambridge Electron Accelerator, Mass.
RADIATION SHIELDING FOR THE CAMBRIDGE ELECTRON ACCELERATOR. M. Stanley Livingston. May 2, 1957. 33p. Contract [AT(30-1)-1909]. (CEA-27(M-H)). $6.30(ph OTS); $3.00(mf OTS).

The radiation shielding requirements for the 6.0-Bev electron synchrotron are analyzed and the plans for fulfilling these requirements are presented. The special problems include (1) overhead shielding for the target area, (2) overhead shielding for the tunnel containing the magnet ring, (3) local and overhead shielding for x-rays from the linac injector, (4) shielding for the adjacent public street, (5) shielding between the target area and the experimental building, (6) local shielding for experimental targets, (7) beam "catcher" traps for intense beams, (8) sky-shine radiation to outside areas. The results of earlier reports are used, and all data employed are in agreement with those presented at the Accelerator Shielding Conference, New York City, April 11-13, 1957. (auth)

11071 AECU-3727
Cambridge Electron Accelerator, Mass.
DAMPING OF OSCILLATION AMPLITUDES BY RADIATION LOSS. K. W. Robinson. Apr. 10, 1957. 8p. Contract [AT(30-1)-1909]. (CEA-28(M-H)). $1.80(ph OTS); $1.80(mf OTS).

It is proven generally that the sum of the damping rates for the three modes of oscillation in an electron synchrotron is given by 2 Vofo/Eo. This result is used to calculate an exact damping rate of the radial betatron oscillations for the Cambridge Accelerator of $-\frac{1}{2}$ Vofo/Eo $(1-\alpha)$. (auth)

11072 AECU-3728 and Suppl.
Cambridge Electron Accelerator, Mass.
DYNAMIC n-MEASUREMENTS ON THE CEA MAGNET MODEL MARK II UNDER AC AND BIASED OPERATION. Hans Nysater. Apr. 16, 1957. 22p. Supplement: NOTES TO CEA-29 ON DYNAMIC n-MEASUREMENTS. June 28, 1957. 4p. Contract [AT(30-1)-1909]. (CEA-29(M-H) and CEA-29-A(M-H)). AECU-3728, $4.80 (ph OTS); $2.70(mf OTS) and AECU-3728(Suppl.), $1.80 (ph OTS); $1.80(mf OTS).

These two reports were issued separately, but are cataloged as a unit.

A method is described to measure dynamic magnetic fields and field gradients to a high accuracy in a strong focusing synchrotron. It employs comparative techniques, peaking strips for timing and an electronic integrator. The method is sensitive down to fields of about 100 gauss. The absolute n-value (field gradient divided by field) is measured to 0.25%, whereas a relative n-distribution over a magnet can be measured to 0.1%. Data are given for CEA Magnet Model Mark II between 100 and 4000 gauss, including influence of a vacuum chamber model. The fact that the magnet ends present a sloping n-face is demonstrated. With a more sensitive pair of gradient search coils, the orbit n-value in the center of a magnet is investigated down to 25 gauss. (auth)

11073 AECU-3730
Cambridge Electron Accelerator, Mass.
INJECTION TRAJECTORIES AND BEAM MATCHING FOR THE CAMBRIDGE ELECTRON ACCELERATOR. K. G. Steffen. Apr. 17, 1957. 43p. Contract [AT(30-1)-1909]. (CEA-30(M-H)). $9.30(ph OTS); $3.60(mf OTS).

Injection trajectories were calculated for different injection conditions for the Cambridge Electron Accelerator, considering also the effect of magnetic fringing fields. The general problem of matching the emittance of the linac to the acceptance of the synchrotron in the transversal phase space is considered, and it is shown that this can be done by a set of two quadrupole lenses. In order to eliminate radial betatron oscillations due to energy deviations of the injected particles, a pulsed electric quadrupole lens in the synchrotron in combination with two deflectors between linac and synchrotron can be used to place particles of different energies on

their specific equilibrium orbits. A layout of the whole injection system following the output of the linac is given. (auth)

11074 AECU-3731
Cambridge Electron Accelerator, Mass.
A REPORT ON THE KINEMATICS OF HIGH ENERGY ELECTRON SCATTERING. Jeremy Bernstein. May 23, 1957. 23p. Contract [AT(30-1)-1909]. (CEA-31(M-H)). $4.80(ph OTS); $2.70(mf OTS).

A convenient summary is given of useful formulas on the kinematics of high energy electron scattering together with a derivation of the relevant formulas for transforming from the center of mass to the laboratory system such parameters as scattering cross sections. The formulas derived hold for any two-body collision; the approximation ($m = 0$) employed for the electron scattering calculations is rigorously true for the elastic scattering of photons. (auth)

11075 AECU-3732
Cambridge Electron Accelerator, Mass.
AMPLITUDE AND PHASE FUNCTIONS FOR THE REVISED PARAMETERS OF THE CAMBRIDGE ELECTRON ACCELERATOR. G. Lanza and K. G. Steffen. May 27, 1957. 7p. Contract [AT(30-1)-1909]. (CEA-32(M-H)). $1.80(ph OTS); $1.80(mf OTS).

The phase and amplitude functions describing the betatron oscillations in the synchrotron are calculated using the revised parameters of the Cambridge Electron Accelerator. The results are given numerically and plotted in a graph for one machine period. (auth)

11076 AECU-3733 and Add. 1
Cambridge Electron Accelerator, Mass.
NOTES ON THE A-2 COMPILER SYSTEM. G. Lanza and M. Wächter. June 6, 1957. 47p. Addendum No. 1. M. Wächter and J. G. Lanza. July 15, 1957. 4p. Contract [AT(30-1)-1909]. (CEA-33(M-H) and CEA-33-A(M-H)). (AECU-3733, $7.80(ph OTS); $3.30(mf OTS) and AECU-3733(Add.1), $1.80(ph OTS); $1.80(mf OTS)).

These two reports were issued separately, but are cataloged as a unit.

An account is given of an extensive study of the A-2 Compiler System for the Remington Rand Univac digital computer. In particular, the following topics are discussed: application and performance of subroutines, segmenting, and introduction of subroutines to the library. (auth)

11077 AECU-3735
Cambridge Electron Accelerator, Mass.
EFFECT OF QUADRUPOLE CORRECTING LENSES. K. G. Steffen. June 3, 1957. 12p. Contract [AT(30-1)-1909]. (CEA-34(M-H)). $3.30(ph OTS); $2.40(mf OTS).

The effect of correcting quadrupole lenses on the betatron oscillation characteristics of an AG synchrotron was studied, and general formulas are given for the fractional changes of the amplitude and phase functions. Calculations performed for different setups of different numbers of lenses for the CEA synchrotron structure point out that one may correct for sizable errors in the n-value by means of 8 pairs of quadrupole lenses in two consecutive straight sections with the focusing lens between defocusing sectors and vice versa. An increase of β_{max} of about 5% is obtained for $\Delta n/n \approx 0.04$. It was found that the necessary corrections can probably be obtained satisfactorily with lenses of 6 in. length. (auth)

11078 AECU-3736
Cambridge Electron Accelerator, Mass.
POLE-FACE WINDINGS. John Rees. June 20, 1957. 15p. Contract [AT(30-1)-1909]. (CEA-35(M-H)). $3.30(ph OTS); $2.40(mf OTS).

A summary is presented of a preliminary study of the application of pole-face windings to the Cambridge Electron Accelerator. Estimates are made of the currents required, the forces on the windings, and the voltages induced by the magnetic flux. The possibility of automatic control of the pole-face currents is explored, and feasible control systems are suggested. (auth)

11079 AECU-3737
Cambridge Electron Accelerator, Mass.
BETATRON OSCILLATION FREQUENCY SHIFT DUE TO "n-ERRORS." G. Lanza and K. G. Steffen. July 1, 1957. 10p. Contract [AT(30-1)-1909]. (CEA-37(M-H)). $3.30(ph OTS); $2.40(mf OTS).

Expressions are found to relate $\Delta\gamma$ to the "n-errors." It is demonstrated that the "integral n-value concept" is of no use in the present case. A modification of "integrated n-value" is suggested. (auth)

11080 AECU-3738
Cambridge Electron Accelerator, Mass.
RADIO-FREQUENCY ACCELERATION III. K. W. Robinson. July 25, 1957. 17p. Contract [AT(30-1)-1909]. (CEA-38(M-H)). $3.30(ph OTS); $2.40(mf OTS).

A further analysis of the strongly couple waveguide cavity system is presented. In this analysis each cavity is considered to be composed of two cavity sections coupled by a reactance, rather than a simple cavity. Also the effects of imperfections in the waveguide are considered. (auth)

11081 AECU-3739
Cambridge Electron Accelerator, Mass.
EQUILIBRIUM ORBIT FOR THE CAMBRIDGE ELECTRON ACCELERATOR. G. Lanza and M. Wächter. July 2, 1957. 7p. Contract [AT(30-1)-1909]. (CEA-40(M-H)). $1.80(ph OTS); $1.80(mf OTS).

The equilibrium orbit in an ideal synchrotron with straight magnets is studied. It is found that for the purpose of calculations one can deal with an equivalent hypothetical synchrotron with curved magnets, provided that the n-value and the focusing length of magnets are properly redefined. (auth)

11082 AECU-3740
Cambridge Electron Accelerator, Mass.
DYNAMIC B AND n-BEHAVIOR UP TO 7600 GAUSS IN MAGNET MODEL MARK II COMPARISON OF RESULTS WITH LONG AND SMALL GRAD COILS. V. P. Henri and H. Nysater. Aug. 13, 1957. 18p. Contract [AT(30-1)-1909]. (CEA-41(M-H)). $3.30(ph OTS); $2.40(mf OTS).

Magnetic measurements were performed, at excitation levels ranging from 4000 to 7600 gauss, to study the dynamic behavior of the magnetic and gradient lengths of the CEA magnet sectors. The influence of the proposed metal vacuum chamber on field and gradient was experimentally determined. Results of measurements made with a 26 in. long grad coil and with small circular grad coils are compared. The reliability of the 26 in. long grad coil is demonstrated. (auth)

11083 AECU-3741
Cambridge Electron Accelerator, Mass.
RADIATION DAMAGE TO VACUUM CHAMBER WALLS. Brenton Stearns. Sept. 10, 1957. 12p. Contract [AT(30-1)-1909]. (CEA-42(M-H)). $3.30(ph OTS); $2.40(mf OTS).

The problem of radiation damage to the walls of two types of vacuum chamber for the 6 Bev Cambridge Electron Accelerator was studied. Radiation damage may arise from the synchrotron radiation and from electrons which are not accepted at injection. The synchrotron radiation produces a large amount of

secondary x radiation which is isotropic, and therefore complicates the arrangement of internal shielding. The 20 Mev electrons from the lines cannot be attenuated by shielding. It is concluded that dosages of the order of 10^7 rad/day near the inflector are unavoidable. This would exceed the allowable dosage for a tube made by cementing a stainless steel liner to supporting ribs, and also exceed the test dosages (so far as we know) for alumina ceramics. (auth)

11084 AECU-3742
Cambridge Electron Accelerator, Mass.
ANALYSIS OF SPURIOUS MODES IN MAGNET POWER SUPPLY. J. Dekleva and K. W. Robinson. Jan. 3, 1958. 8p. Contract [AT(30-1)-1909]. (CEA-43(M-H)). $1.80(ph OTS); $1.80(mf OTS).

The resonant frequencies of the magnet power supply are investigated. It is found that there are eleven resonant modes in addition to the desired mode of operation with six additional resonant frequencies. From measurements of the choke model, it appears that the frequencies of some of the spurious modes may lie in the same range as the desired mode of operation. (auth)

11085 AECU-3743
Cambridge Electron Accelerator, Mass.
RADIATION EFFECTS IN CIRCULAR ELECTRON ACCELERATORS. Kenneth W. Robinson. Jan. 6, 1958. 26p. Contract [AT(30-1)-1909]. (CEA-44(M-H)). $4.80(ph OTS); $2.70(mf OTS).

The effects of radiation emission on the motion of electrons in high energy synchrotrons are analyzed. The damping rates and quantum excitation of the three principal modes of oscillation are derived for strong focusing and constant gradient accelerators. Methods for correcting the radiation effects for strong focusing accelerators are discussed. (auth)

11086 AECU-3744
Cambridge Electron Accelerator, Mass.
BETATRON OSCILLATIONS AND EQUILIBRIUM ORBITS IN TERMS OF AMPLITUDE AND PHASE FUNCTIONS. K. G. Steffen. Jan. 7, 1958. 11p. Contract [AT(30-1)-1909]. (CEA-45(M-H)). $3.30(ph OTS); $2.40(mf OTS).

Formulas are given to express the general particle trajectory and the equilibrium orbit for a slightly disturbed synchrotron in terms of the amplitude and phase functions for the ideal machine. If these functions are known, orbit computations can be carried out by simple integration procedures. The formalism is expected to be useful especially for considerations such as beam alignment or generation of an external electron beam. Some equations given earlier are repeated for completeness. (auth)

11087 AECU-3745
Cambridge Electron Accelerator, Mass.
EXIT BEAM TRAJECTORIES FOR THE CAMBRIDGE ELECTRON ACCELERATOR. K. G. Steffen. Jan. 30, 1958. 12p. Contract [AT(30-1)-1909]. (CEA-46(M-H)). $3.30(ph OTS); $2.40(mf OTS).

A method is outlined for calculating the trajectories, through the magnetic field of the following magnet pair of positive and negative particles of different momenta produced in a target. Representative trajectories were computed by this method and are given numerically. (auth)

11088 AECU-3746
Cambridge Electron Accelerator, Mass.
THE INPUT ADMITTANCE OF A RING CIRCUIT. J. R. Rees. Jan. 22, 1958. 9p. Contract [AT(30-1)-1909]. (CEA-47(M-H)). $3.30(ph OTS); $2.40(mf OTS).

A ring circuit is a succession of two-port networks and at least one three-port network, each feeding the next at one port and the last feeding the first so that the sequence closes on itself leaving at least one input port. The input admittance is derived in terms of various matrices describing the circuit for one- and two-input-port rings. (auth)

11089 AECU-3749
Stanford Univ., Calif. Microwave Lab.
THEORY OF THE CONSTANT GRADIENT LINEAR ELECTRON ACCELERATOR. R. B. Neal. May 1958. 36p. Contract AT(04-3)-21. $6.30(ph OTS); $3.00(mf OTS). (ML-513).

The effect of beam loading upon the design and performance of the accelerator is examined. Results are given in dimensionless form so that the various equations and graphs can be used at any operating frequency. The constant gradient accelerator is somewhat less subject to beam loading than the uniform accelerator structure. For an accelerator of given filling time and length, it should be possible to obtain ~5 to 20% more beam power with the constant gradient machine. (W.L.H.)

11090 ML-439
Stanford Univ., Calif. Microwave Lab.
A THEORETICAL ANALYSIS OF LINEAR ACCELERATORS USING EQUIVALENT CIRCUITS AND CAVITY NORMAL MODES. Kent G. Dedrick. March 1958. 28p. Contract AT(04-3)-21. $4.80(ph OTS); $2.70(mf OTS).

It can be shown that a linear accelerator can be described as a periodic inductively loaded transmission line. The inductive loading is necessary to reduce the phase velocity of the accelerator to the velocity of the electrons being accelerated, that is; the phase velocity of light. The beam hole region of the accelerator is treated as the transmission line and the remainder of the structure as reactive loading. The loading is treated as equivalent circuits and also by expanding the fields in these regions in terms of Slater's cavity modes. The equivalent circuit method is of use in analyzing the effect of coupling between cavities and of other gross effects. The cavity mode expansion is useful in obtaining more detailed information on the properties of an accelerator. In fact, the group velocity of the Stanford linear accelerator structure is given to within 30 per cent by considering the contribution due to only one cavity mode, viz; the lowest frequency mode. This is a result from the operating frequency being very near the frequency eigenvalue of this lowest mode. The over-all loading must be inductive, but if there is in addition a great deal of capacity as well, considerably more energy must be stored in the accelerator than is needed for purely inductive loading. In the presently used structure, the presence of considerable capacity is betrayed in the fact that the operating frequency is indeed very close to the lowest eigenvalue. Thus, one of the problems in designing more efficient accelerators is that of designing a more nearly perfect inductance at microwave frequencies. The calculations were carried through assuming no losses, either through beam loading or resistive wall loss. (auth)

11091 ML-518
Stanford Univ., Calif. Microwave Lab.
DEVELOPMENT OF A LINEAR ELECTRON ACCELERATOR FOR MEDICAL AND RADIOGRAPHICAL PURPOSES. Final Report, March 1, 1952 to May 31, 1958. May 1958. Includes reprint: THE STANFORD MEDICAL LINEAR ACCELERATOR. I. DESIGN AND DEVELOPMENT. Edward L. Ginzton, Kenneth B.

Mallory, and Henry S. Kaplan. Stanford Med. Bull. 15, 123-40(1957). 39p. Contract Nonr-225(06).

A sealed-off linear electron accelerator for medical use has been developed, and its operation for routine cancer therapy has proved very satisfactory. The construction of more compact accelerators operating at shorter wavelengths was shown to be feasible. The major cost of such accelerators is in the r-f power supply and the mechanical mounting, and it is in these components that further development is required if the over-all cost is to be significantly reduced. (auth)

11092 MURA-406

Midwestern Universities Research Assn., Madison, Wis.
SCALING RADIAL SECTOR FFAG ACCELERATORS WITHOUT MEDIAN PLANE SYMMETRY. F. T. Cole. May 26, 1958. 25p. Contract AT(11-1)-384. $4.80 (ph OTS); $2.70(mf OTS).

The effect of radial median plane fields on particle orbits of the two-way FFAG accelerator is considered. The equilibrium orbit and linear motion about it are treated. It is found that the circumference factor can be lowered, but that the vertical focusing is seriously weakened. (auth)

11093 PLAC-8

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
ALIGNMENT OF DRIFT TUBES IN A 600 MEV PROTON LINEAR ACCELERATOR. R. E. Clay. Dec. 13, 1954. 10p.

An optical method for setting the drift tubes of a 600-Mev proton linear accelerator in line is described and figures given of the accuracy that may be expected. A travelling microscope for determining the positions of the drift tubes along the axis to an accuracy of 0.001 in. is described. (auth)

11094

ON THE PROBLEM OF PARTICLE GROUPINGS IN A TRAVELING WAVE LINEAR ACCELERATOR. G. I. Zhileyko. Atomnaya Energiya 3, 245-7(1957).

A linear accelerator with "traveling" waves may be used for the production of especially short electron momenta, although in many cases the grouping capacity of the accelerator is not sufficient. Theoretically the case is derived in which grouping of the electrons takes place in the accelerator itself. (With 3 Illustrations and 1 Slavic Reference). (TCO)

11095

ON ACCELERATORS WITH "SIMILAR ORBITS." A. A. Kolomenskiy. Atomnaya Energiya 3, 492-7(1957).

The conditions which a magnetic system has to fulfill so that the frequencies of the radial as well as the vertical betatron oscillations do not depend on the momentum of the particles to be accelerated are deduced theoretically. The orbits are called "dynamically similar ones." In such systems, in principle, the build-up of betatron oscillations, which are related to the synchrotron oscillations and other phenomena, should not be present. A magnetic field with $H_0(\theta)(\nu_0/\nu)^{n_0}$, where n_0 is constant, guarantees geometrically, as well as dynamically, similar orbits. In slightly focusing accelerators with sectors and in highly focusing synchrophasotrons (Russian cosmotron and betatron) there are no dynamically similar orbits. In order to obtain this similarity for the first case, in addition to n_0 = constant, the single sectors of the magnet must have a center in common. For the specific case of the annular phasotron (synchrocyclotron), the following conditions are investigated, the centers of the adjacent sectors are situated on different sides of the ring, and the centers of the adjacent sectors are coincident in the center of the accelerator. In the latter case dynamically similar orbits exist. The possibility of constructing an annular phasotron so that, in the ring, two particles can steadily move in opposite directions at the same time is discussed. (TCO)

11096

STUDY AND DEVELOPMENT OF CYCLIC ELECTRON ACCELERATORS AT THE TOMSK POLYTECHNICAL INSTITUTE. A. A. Vorob'ev and V. A. Moskalev. Atomnaya Energiya 4, 229-37(1958) Mar. (In Russian)

A brief description is given of the basic parameters and design of several betatrons. Various methods for extracting the electron beams from the acceleration chamber are discussed. Special attention is devoted to betatrons with an electron energy of 25 Mev. A report is given on the annular accelerating electrodes connected to the outer double conduction resonance line used in 30-Mev synchrotrons. (tr-auth)

11097

ACCELERATORS WITH STABLE OVERLAPPING PARTICLE TRAJECTORIES. E. M. Moroz. Atomnaya Energiya 4, 238-43(1958) Mar. (In Russian)

The features of a new type accelerator with a magnetic system consisting of several sectors separated by weak intermediate fields are described. The magnetic system has two mutually perpendicular symmetric planes but does not possess either axial or central symmetry. All orbits of the particles cross at the same point in which is found the accelerator element (the endovibrator). The particle motion stability is secured by the actions of the sector boundary fields. The magnetic systems can be used in cyclotrons and microtrons. The new type accelerator furnishes a higher intensity of accelerated ion beams, demands a weaker feeding source, and permits the release of particles from any orbit with a wide range of energies in the extracted beams. (tr-auth)

11098

A 6 Mev LINEAR ACCELERATOR FOR ELECTRONS. O. A. Val'dner, O. S. Milovanov, G. A. Tyagunov, and A. V. Shal'nov. Atomnaya Energiya 4, 285(1958) Mar. (In Russian)

A previously described 4.5-Mev linear electron accelerator was improved by raising its electron energy up to 6 Mev without increasing the high-frequency power demand. (R.V.J.)

11099

SPECTRAL CHARACTERISTICS OF THE RADIATION EMITTED BY ELECTRONS ACCELERATED IN A SYNCHROTRON. D. H. Tomboulian and D. E. Bedo (Cornell Univ., Ithaca, N. Y.). J. Appl. Phys. 29, 804-9(1958) May.

Expressions are developed for the average power radiated by a high-energy electron moving in a circular orbit. The instantaneous electron energy E(t) is assumed to vary with the time in accordance with $E(t) = E_m \sin^2(\pi t/2T)$. Spectral distributions are obtained corresponding to the radiation emitted over a partial or full acceleration interval. The numerical results predicted from the general relations are examined for a particular value of the peak energy E_m = 6.0 Bev and the orbital radius R = 86.14 ft. In the case of these parameters, the continuous spectrum attains a peak at 0.36 A. Other numerical calculations, related to the case where the radiation is collected only over the low-energy portion of the acceleration interval, indicate that it is feasible to utilize the continuum as a source for

measurements in problems of interest to astrophysics and solid-state spectroscopy. (auth)

11100

SPIRAL RIDGE CYCLOTRON PARTICLE DYNAMICS APPLIED TO CONVERSION OF THE HARWELL SYNCHROCYCLOTRON. N. M. King and W. Walkinshaw (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Instr. 2, 287-98(1958) May.

A theoretical design study for conversion of the Harwell synchrocyclotron to spiral ridge operation is outlined. Effects due to non-linearities in the dynamics have a major influence on the design. The initiation of large radial betatron oscillations at the center of the machine could have serious consequences, and experimental model studies are now in progress to examine the problem. Apart from this, the suggested conversion should be feasible with careful design and construction. (auth)

11101

AN APPLICATION OF A RIBBON LENS TO THE FOCUSSING OF THE EXTERNAL BEAM OF A CYCLOTRON. Ye. S. Mironov, L. M. Nemenov, S. B. Zvyagin, and R. A. Meshcherov. Pribory i Tekh. Ekspt. No. 5, 18-21(1957). (In Russian)

An electrostatic focusing device for the external beam of the 1.5 m cyclotron is described. The system, consisting of molybdenum ribbons, is shown. The system focuses the beam in the vertical direction, focusing in the perpendicular direction being carried out by a magnet (not described). Performance measurements were obtained using 12 Mev protons. The ribbon lens increases the current density by a factor of 10. Particle losses did not exceed 10%. The current density at the target was 15 $\mu a/cm^2$. (TCO)

11102

A BAR CATHODE FOR ION SOURCE OF A CYCLOTRON. V. S. Panasyuk. Pribory i Tekh. Ekspt. No. 5, 111(1957). (In Russian)

The main disadvantage of spiral wire cathodes for the ion source of a cyclotron is the inconvenience of adjustment connected with the necessity of bringing out leads and also the small working life. The adjustment and the exchange of the wire is often carried out in the immediate neighborhood of the cyclotron and often involves a radiation hazard. If the cathode is made in the form of a tungsten cylinder heated by induction currents, these disadvantages can be removed. The working life of such a cathode can be much longer than that of a wire cathode. The present work describes a cathode induction heated by means of a high-frequency generator. The inductor is in the form of a coil made of copper tube and is water-cooled. The power necessary to heat a tungsten cathode to a temperature of about 2800°C is of the order of 400 w. A part of the construction of an ion source with induction heating of a rod cathode and the magnified picture of the rod cathode is shown. A disadvantage of the heater (inductor) is its fusibility. When the flow of water is slightly reduced, the inductor may become overheated. It is, therefore, better to use a high melting point material such as tantalum. (TCO)

11103

INCREASING THE BEAM-TARGET IMPACT TIME IN SYNCHROTRONS AND SYNCHROPHASOTRONS. V. I. Kotov and L. L. Sabsovich. Pribory i Tekh. Ekspt. No. 6, 19-21(1957).

A new method of displacing the beam in the 250-Mev synchrotron of the Academy of Sciences, USSR, is described. If one slowly lowers the amplitude of the high-frequency accelerating voltage, the region of stability becomes smaller and the particles gradually become non-synchronous. These particles do not, on the average, receive any energy from the accelerating system and moving along spirals they impinge upon the target. With such a mechanism of displacing the beam one can considerably increase the duration of the beam-target interaction. The duration of the pulse at the target depends on the rate of fall of the amplitude of the HF, the smaller the rate of fall the longer the duration of the pulse. It is shown that the only limitation on this effect is the momentum spread introduced by the above procedure. The amplitude of the HF is calculated subject to the condition that the particle flux at the target is constant. (TCO)

11104

MEASUREMENT OF THE ABSOLUTE MAGNITUDE OF THE MAGNETIC FIELD OF A CYCLOTRON WITHOUT RELEASING THE VACUUM. L. F. Kondrashev and V. S. Panasyuk. Pribory i Tekh. Ekspt. No. 6, 79-80 (1957). (In Russian)

A magnetometer using the principle of nuclear resonance absorption is described. The instrument was constructed in 1951 and was used on the 1.5 m cyclotron. Measurements were carried out in the range 11 to 12 kilogauss. The instrument is very small in size (30 mm in diameter and 1200 mm long) and could therefore be introduced in the form of a probe into the accelerating chamber of the cyclotron. The accuracy of the method can be of the order of 10^{-4}%; the accuracy actually used was 10^{-1}%. (TCO)

11105

PHYSICAL FACTORS IN THE DESIGN OF THE 10-BEV PROTON SYNCHROTRON. V. I. Veksler, A. A. Kolomenskii, V. A. Petukhov, and M. S. Rabinovich. Soviet J. Atomic Energy (English Translation), Suppl. No. 4, 1-7(1958).

The physical factors involved in the design of the 10-Bev proton synchrotron at the Academy of Sciences, USSR, are discussed. The following topics are considered: a general theory for the motion of particles at different stages of the acceleration cycle; the effect of different perturbations and resonances in betatron and synchrotron oscillations; tolerances for the various parameters; and basic requirements for the auxiliary apparatus. (J.S.R.)

11106

MAGNETIC CHARACTERISTICS OF THE 10-BEV PROTON SYNCHROTRON OF THE JOINT INSTITUTE FOR NUCLEAR RESEARCH. A. A. Zhuralev, E. G. Komar, I. A. Mozalevskii, N. A. Monoszon, and A. M. Stolov. Soviet J. Atomic Energy (English Translation) Suppl. No. 4, 8-16(1958).

The magnetic field of the proton synchrotron at the Joint Institute for Nuclear Research is characterized by the following parameters: peak magnetic field intensity at the equilibrium orbit (R = 2800 cm), H_{max} = 13,000 gauss; field intensity at injection, H_0 = 150 gauss; gap height between the poles at the equilibrium orbit, δ = 40 cm; and width of the pole piece, b = 200 cm. Because of the need for meeting extremely severe magnetic tolerances, it was necessary to work out effective methods for correction of the magnetic field before the accelerator was built. A small model was built for preliminary investigation of the magnetic characteristics; the final study of the magnetic characteristics and the development of methods for correcting the magnetic field were performed on segments, each segment being $^1/_{48}$ of the circular magnet. The methods used in deriving the static and dynamic characteristics are given in

detail. The magnetic characteristics obtained in studies of the individual segments and the methods of field correction developed were completely verified during the tests and adjustments of the assembled electromagnet. (J.S.R.)

11107

CYCLOTRON WITH SECTOR-MAGNET SYSTEM. E. M. Moroz and M. S. Rabinovich. Soviet J. Atomic Energy (English Translation) Suppl. No. 4, 17-19(1958).

In a cyclotron the frequency ω_λ of the voltage applied to the dees must be equal to the frequency of rotation ω of a particle in its orbit. Consequently the mean magnetic field along the orbit must increase as the energy E of the accelerated particle is increased. If the magnet consists of sectors with different values of magnetic field intensity (which do not increase with radius) it is possible to realize an increase in the mean value of the field by judicious choice of the boundaries of the magnetic sectors. The stability of particle motion in an accelerator of this type is provided by the focusing action at the edge of the magnetic sectors. The dimensions of the stability region and the limiting particle energy depend on the number of magnetic sectors N. It is shown that with $N \geq 4$, it is possible to accelerate protons to an energy of 500 Mev without passing through the most dangerous resonances. The allowable deviation of the magnetic field intensity is $\frac{\Delta H}{H} = \frac{eV \cos\phi}{m_0c^2}\left(1 + \frac{m_0c^2}{W_f}\right)\frac{\sin\phi_f - \sin\phi_i}{2\pi}$ where $eV\cos\phi$ is the energy acquired by the particle per revolution, W_f is the energy at the end of acceleration, ϕ_i and ϕ_f are the phase angles of the electric field (at the instant the particle passes through the accelerating gap between the dees) at the beginning and end of acceleration. (J.S.R.)

11108

CERTAIN FEATURES OF HIGH-ENERGY CYCLIC ELECTRON ACCELERATORS. A. A. Kolomenskii and A. N. Lebedev. Soviet J. Atomic Energy (English Translation) Suppl. No. 4, 20-33(1958).

The most important feature of the high-energy electron synchrotron is the intense electromagnetic radiation due to the relativistic motion of the electrons in the magnetic field of the accelerator. It is shown that the electron motion may be considered classical up to the maximum possible energies. However, account must be taken of the statistical nature of the quantum fluctuations of the radiation itself in treating the electron motion. The motion of an electron in an accelerator with an axially symmetric magnetic field with radiation present is considered, and the equations for the change of amplitude of the betatron and synchrotron oscillations are derived within the framework of the classical theory starting with the relativistic equation for the motion for a point electron. The effect of radiation fluctuations on electron motion in an accelerator with an axially symmetric field is next considered, and the equation for the amplitude of the z oscillations is given. Betatron oscillations in periodic magnetic systems in the presence of radiation and the damped-oscillation method are discussed. Several methods of overcoming radiation "blow-up" are suggested. The effect radiation fluctuations on betatron and synchrotron oscillations in periodic magnetic systems is analyzed. To complete the description of the electron motion in accelerators, the effect of the discrete action of the accelerating gaps is considered. (J.S.R.)

11109

INCOHERENT ELECTRON RADIATION IN A SYNCHROTRON AND CERTAIN APPLICATIONS IN INVESTIGATING ACCELERATOR OPERATION. Iu. M. Ado and P. A. Cherenkov. Soviet J. Atomic Energy (English Translation) Suppl. No. 4, 34-9(1958).

When electrons are accelerated in cyclic accelerators to energies of the order of 100 Mev and higher, rather strong radiation of electromagnetic waves is observed. The spectral composition of this radiation changes with the electron energy. The relative energy distribution in the radiation spectrum of monoenergetic electrons with energies of 150, 225, and 250 Mev was measured in the region from 4000 to 6100 A. A study of the dependence of the various harmonics of the incoherent radiation on electron energy (from 80 to 260 Mev) was made. By measuring the absolute flux of radiated energy in a narrow spectral region, it was possible to determine the number of electrons accelerated in the synchrotron phase. An experimental method for investigating the radial phase oscillations of electrons in the synchrotron, based on the fine structure of the radiation, was also presented. (J.S.R.)

11110

FEATURES OF THE 280-MEV SYNCHROTRON AT THE INSTITUTE OF PHYSICS, ACADEMY OF SCIENCES, USSR. A. Ia. Beliak, V. I. Veksler, V. N. Kannunikov, P. A. Cherenkov, and B. N. Iablokov. Soviet J. Atomic Energy (English Translation) Suppl. No. 4, 40-51(1958).

The synchrotron at the P. N. Lebedev Institute of Physics, Academy of Sciences, USSR, was first put into operation in 1949. Since then many of the basic elements of this accelerator have been improved and modified; certain elements have been redesigned and rebuilt. A brief description is given of the accelerator and of the modifications which were made. (J.S.R.)

11111

EXPERIMENTAL BASIS FOR THE THEORY OF PARTICLE CAPTURE IN BETATRON ACCELERATION. Iu. N. Lobanov and V. A. Petukhov. Soviet J. Atomic Energy (English Translation) Suppl. No. 4, 52-8(1958).

Attempts to formulate an analysis of electron capture in the betatron have not been successful because there has been no single point of view as to the mechanism of betatron capture. To delineate the capture mechanism and to acquire the necessary information for formulating an analysis of capture, an experimental investigation was made on the effects which occur in a betatron during injection and in the initial stages of acceleration. Studies were made of the dependence of electron capture efficiency on various injection parameters: duration of the starting period, pulse amplitude, and time of injection. In addition the effect of varying the frequency of the betatron magnetic field and the effect on the injection process of introducing additional space charge into the chamber and other changes in starting conditions were experimentally investigated. The experiments were made using a 3-Mev betatron especially designed for this purpose. (J.S.R.)

11112

THEORY OF PARTICLE FOCUSING IN A LINEAR ACCELERATOR USING A SYSTEM OF TRANSVERSE LENSES. A. A. Sharshanov. Soviet J. Atomic Energy (English Translation) Suppl. No. 4, 59-66(1958).

A study of the properties of a system of transverse lenses which alternately focus and defocus a beam in two mutually perpendicular directions involves the investigation of a second-order linear differential equation with periodic coefficients. Because of particle ac-

celeration and because the external field is not precisely periodic, the equation of motion, although linear, is not an equation with periodically varying coefficients. Under certain conditions it may be assumed that the parameters which characterize these coefficients are slowly varying along the accelerator. A calculation which takes space charge into account leads to nonlinear equations with periodic coefficients. The linear second-order equations with periodic coefficients and with coefficients which are almost periodic are studied, as well as the nonlinear equations with periodic coefficients which take account of space charge. The method employed is one in which the equations are compared with simpler equations having constant (or almost constant) coefficients. The solutions of the simple equations coincide with the solutions being sought only at certain points, which are separated by a distance equal to the characteristic period of the coefficients. The nonlinear equations can be compared only approximately with the simple equations. (J.S.R.)

11113

ON NEW POSSIBILITIES TO RAISE THE EFFICIENCY OF CHARGED-PARTICLE ACCELERATORS. E. M. Moroz (P. N. Lebedev Physical Inst., Academy of Sciences, USSR). Soviet Phys. (Doklady) 2, 311-12(1957) July-Aug.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 624.

11114

THEORETICAL BASIS OF RESONANCE ACCELERATORS. V. I. Kotov, A. B. Kuznetsov, and N. B. Rubin. Uspekhi Fiz. Nauk 64, 197-272(1958) Feb. (In Russian)

A review is given of the theoretical basis for the development of the modern resonance accelerators. The phasing properties, the stability of motion of particles in magnetic fields, and the effects of various perturbing influences on the motion of particles are analyzed. The performance of the various cyclic resonance accelerators such as synchrotrons, phasatrons, synchrocyclotrons, synchrophasatrons, and microtrons, as well as the performance of linear and strong-focusing accelerators, is discussed. 84 references. (R.V.J.)

Radiation Absorption and Scattering

Refer also to abstracts 10874 and 10943.

11115 AFOSR-TN-58-410

Stanford Univ., Calif.

IMPROVED SUM RULE FOR ELECTRON-DEUTERON SCATTERING. Technical Report No. 29. R. Blankenbecler. May 1958. 29p. Project No. 3750-37504. Contract AF18(600)-545. (AD-158213).

A qualitative discussion of the approximations implicit in the present theoretical treatment of the deuteron is presented. An improved sum rule which relates the total elastic and inelastic scattering of electrons from the deuteron to the free electron-nucleon cross sections is derived. It has the property of reducing to the correct relativistic result upon neglect of binding. It is proved that the use of folded nucleon and nuclear form factors is correct. It is shown that the finite-nucleon size does not affect any real photon process. (auth)

11116 NP-6726

Pennsylvania. Univ., Philadelphia.

TOTAL PHOTON ABSORPTION IN C^{12} AND O^{16}. Technical Report No. 4. Milo M. Wolff. May 1958. 73p. Contract Nonr-551-(17).

Numerous investigations have been concerned with the problem of structure in the excitation functions of photonuclear reactions, particularly in the region of the giant resonance 8 to 30 Mev. Broad structure with widths greater than 200 kev was found by the analysis of tracks in photographic emulsions as a result of (γ,p) and (γ,α) reactions. Changes in the slope of betatron yield curves for $C^{12}(\gamma,n)C^{11}$, $O^{16}(\gamma,n)O^{15}$, and others have been interpreted as narrow resonances—widths less than 100 kev. A direct absorption measurement has been done in which samples were interposed between a sodium iodide scintillation detector and the tritium target of a Van de Graaff accelerator. The energy of the monochromatic photons produced at the tritium target was varied from 20.3 to 20.8 Mev by changing the accelerated proton energy. The resolution (70 to 100 kev) and sensitivity (8 to 10 mb) of the experiment were sufficient to detect structure reported in the $C^{12}(\gamma,n)C^{11}$ reaction. The results of the experiment show that structure in the total gamma absorption of C^{12} does not exist to the extent predicted by L. Katz and co-workers. They are not inconsistent with broader structure previously found in (γ,p) reactions. These results were confirmed by experiments of Dr. Katz who has concurrently revised downward the previously reported narrow level strengths in $C^{12}(\gamma,n)$. Values of the total absorption coefficients for water and for C^{12} are given. (auth)

11117 NYO-2172

Rochester, N. Y. Univ.

ELASTIC SCATTERING OF PROTONS BY CHROMIUM, VANADIUM, IRON, AND COBALT. Charles A. Preskitt, Jr. and W. P. Alford. Mar. 17, 1958. 91p. Contract AT(30-1)-875. $15.30(ph OTS); $5.40(mf OTS).

An attempt was made to measure the energy variation of low-energy proton elastic scattering from nuclei. Target nuclei were chosen on the basis of their large spin differences, available isotopic purity, their resolvable excited states, their atomic number, and their long-period physical and chemical stability. A total of thirty-three angular distributions were measured. Both tabulations and plots of the data are given. The data were examined and characteristic features of the distributions are discussed. (D.E.B.)

11118 UCRL-5229

California. Univ., Livermore. Radiation Lab.

DIRECT INTERACTION NEUTRONS FROM 14-MEV INELASTIC NEUTRON SCATTERING. Malcolm H. MacGregor. May 19, 1958. 4p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

Neutron nonelastic cross sections measured at different detector biases have been used to determine the cross sections for inelastically scattering 14-Mev neutrons into 9- to 14-Mev energy range. The cross section for producing these high-energy neutrons, which may be attributed to direct interaction processes, is roughly 10% of the nonelastic cross section, for all elements. A comparison is made with data of Coon and co-workers, who measured angular distributions for the same high-energy inelastically scattered neutron group. (auth)

11119 NP-tr-89

APPLICATION OF OPTICAL MODEL FOR HIGH ENERGY π-P AND P-P SCATTERING ANALYSIS. V. G. Grishin, I. S. Saitov, and I. V. Chuvile. Translated from a publication of the Joint Institute for Nuclear

Research, U.S.S.R. 1958. 23p. (Translation partially illegible.)

Experimental data on $\pi^- - p$ and p-p scattering at the energies above 1 Bev have been analyzed, considering the nucleon as an optically uniform sphere with sharp edges. It is shown that the data presently available may be described by means of the sphere of radius $R = (1.08 \pm 0.07) \times 10^{-13}$ cm which is independent either of the type of the colliding particles or their energy. The optical characteristics of this sphere are evaluated. The contributions from the imaginary and the real parts of the scattering amplitude are estimated. It is assumed that for the 1.37-Bev pions and for the proton energies above 5 Bev the contribution from the real part of the scattering amplitude is small and the analysis of the scattering phenomena at high energies may be carried out using either the general scattering theory without taking into account the spin characteristics of the interaction or using the model of a purely absorbing sphere. (A.C.)

11120 NP-tr-96

POLARISATION IN ELASTIC SCATTERING AT HIGH ENERGIES. L. I. Lapidus. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1957. 15p. (Translation partially illegible.)

Polarization phenomena in elastic scattering at high energies are considered. It is shown that it is possible to obtain nucleon beams with considerable polarization in the elastic scattering at small angles. The applicability of "black nucleus" and "gray absorbing nucleus" approximation to p-p scattering at high energies is discussed. (auth)

11121 NP-tr-98

APPROXIMATE DISPERSION RELATIONS FOR NUCLEON-NUCLEON SCATTERING. V. Z. Blank and P. S. Isaev. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1957. 7p.

Dispersion relations previously obtained could not be compared with experiment because they involved non-observed magnitudes and also unknown magnitudes connected with antinucleon-nucleon scattering. In this paper the approximate dispersion relations are investigated. The nucleon-nucleon scattering in the absence of antinucleons is considered. (A.C.)

11122

MULTIPLE-SCATTERING CORRECTIONS IN SPHERICAL AND RING GEOMETRIES. V. F. Turchin. Atomnaya Energiya 4, 244-9(1958) Mar. (In Russian)

A method for making multiple-scattering corrections in the measurement of angular distribution of elastically scattered neutrons is offered. The mean path of the scattered neutron in the specimen is considered to be comparable to the free neutron path. The probability of the double, triple, and multiple scattering of neutrons by spherical, annular, and rectangular cross sections was calculated. For the anisotropic neutron scattering at energies of several Mev the cross section appears as $\sigma(\theta) = \sigma_1(\theta) + \sigma_2(\theta)$, where $\sigma_1(\theta)$ is the forward peak and $\sigma_2(\theta)$ is isotropic. The elastic scattering is conditionally divided into two types and the double scattering into four types. The probabilities of double scattering for all four types and for triple and multiple scattering are calculated on the basis of the results obtained for the isotropic scattering. (tr-auth)

11123

PHOTOELECTRIC ABSORPTION OF SCATTERED γ-RAYS. M. M. Sokolov, A. P. Ochkur, A. A. Fedorov, and N. I. Karabanov. Atomnaya Energiya 4, 284-5(1958) Mar. (In Russian)

The scattered γ-ray spectra in small-Z media composed of various admixtures of heavy metals were studied. A diagram of the scattered γ-ray spectra from a Cr^{51} source is included. (R.V.J.)

11124

REMARKS CONCERNING THE DISPERSION OF π MESONS ON NUCLEONS. B. M. Stepanov. Doklady Akad. Nauk S.S.S.R. 118, 911-12(1958) Feb. 11. (In Russian)

It is shown that the assumption of π-meson simplicity is not compulsory for the derivation of dispersion equations. The assumption of nucleon simplicity is sufficient. (R.V.J.)

11125

STATISTICAL PROBLEMS IN ENERGY LOSS AND IONIZATION PROCESSES. Jackson R. Herring and Eugen Merzbacher (Univ. of North Carolina, Chapel Hill). J. Elisha Mitchell Sci. Soc. 73, No. 2, 287-79 (1957) Nov.

The probabilities of Moyal's modification of Landau's distribution were calculated. The calculation requires the knowledge of the probability that a primary ionizing collision results in the creation of k ion pairs. The average energy expended per ion pair produced is calculated, and this quantity is examined as to its dependence on the primary energy and the nature of the incident particle. The variance of the number of ion pairs is calculated. (W.D.M.)

11126

BROAD AND NARROW BEAM ATTENUATION OF Ir^{192} GAMMA RAYS IN CONCRETE, STEEL, AND LEAD. Victor H. Ritz (National Bureau of Standards, Washington). J. Soc. Non-Destructive Testing 16, 269-72(1958) May-June.

Broad and narrow beam attenuation curves were obtained experimentally for Ir^{192} gamma rays in concrete, steel, and lead. The results were compared with those of other workers. The narrow beam attenuation curves were found to agree with calculated theoretical curves. (auth)

11127

DIRECT INTERACTION IN THE INELASTIC SCATTERING OF HIGH ENERGY PROTONS IN CARBON. C. B. O. Mohr (Univ. of Melbourne). Proc. Phys. Soc. (London) 71, 717-23(1958) May.

The angular distribution of elastic and inelastic scattering of 89 Mev protons in carbon is calculated on the distorted wave approximation, assuming direct interaction in inelastic collisions. Different forms of nuclear potential are tried, and it is found that a satisfactory fit with the experimental curves may be obtained, provided direct interaction is assumed to take place throughout the nuclear volume, and not just at the surface. The Born approximation gives diffraction minima which are much too low, at angles which are appreciably too large; and gives far too little scattering at small angles for electric quadrupole excitation. (auth)

11128

DISPERSION THEORY OF THE DIRECT PHOTOEFFECT. G. E. Brown and J. S. Levinger (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) 71, 733-41(1958) May.

The process of direct interaction with photons (the emission of fast particles) is formulated in nuclear dispersion theory. The cross section can be evaluated for energies far from the single particle resonances; an order of magnitude estimate can be made for the region of the resonances. The results are in rough agreement with those from Wilkinson's modified shell model. The

dipole–quadrupole interference is estimated to give an appreciable forward asymmetry for photon protons. (auth)

11129

THE ELASTIC SCATTERING OF 380 Mev PROTONS BY PROTONS. I. AT ANGLES GREATER THAN 30° (c.m.). D. Harting, J. R. Holt, and J. A. Moore (Univ. of Liverpool). Proc. Phys. Soc. (London) 71, 770-80 (1958) May.

The proton–proton differential elastic scattering cross section at 380 Mev was accurately measured over the angular range 30° to 90° (c.m.). Coincidences between scattered and recoil protons were counted, using targets of polyethylene and carbon, and the number of incident protons determined with a calibrated ionization chamber. At 90° the differential cross section is 3.70 ± 0.06 mbn sterad^{-1} and increases at smaller angles to a value 9% greater at 30°. (auth)

11130

THE ELASTIC SCATTERING OF 380 Mev PROTONS BY PROTONS. II. AT ANGLES LESS THAN 30° (c.m.). J. R. Holt, J. C. Kluyver, and J. A. Moore (Univ. of Liverpool). Proc. Phys. Soc. (London) 71, 781-8(1958) May.

Measurements on the proton–proton differential elastic scattering cross section at 380 Mev were made within the angular range 4 to 30° (c.m.). A target of liquid hydrogen was used and a threshold Čerenkov counter was included in the detecting telescope to eliminate particles from inelastic processes. The total cross section for deuteron production was found to be 0.57 ± 0.08 mbn. (auth)

11131

POLARIZATION IN NUCLEAR REACTIONS. J. N. Lyness (Univ. of Malaya, Singapore). Proc. Phys. Soc. (London) 71, 858-60(1958) May.

In order to take into account polarization effects in the scattering of low energy neutrons by medium and heavy nuclei, the square well optical model was modified by adding to the potential a spin-orbit term. (W.D.M.)

11132

LOW ANGLE X-RAY SCATTERING FROM COLD-WORK METALS. A. Franks and K. Thomas (National Physical Lab., Teddington, Middlesex, Eng.). Proc. Phys. Soc. (London) 71, 861-2(1958) May.

The low-angle scattering from individual grains of a fatigued polycrystalline copper foil 0.002 in. thick was studied in detail using a technique in which the specimen can be accurately oriented with respect to the beam and in which both large-angle and small-angle photographs can be obtained on the same film. It is concluded that the low-angle scattering is caused by double Bragg reflection. (W.D.M.)

11133

THE POLARIZATION-ASYMMETRY EQUALITY. J. S. Bell and F. Mandl (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Proc. Phys. Soc. (London) 71, 867-8(1958) May.

The polarization-asymmetry equality for the elastic scattering of spin ½ particles by unpolarized particles was previously reconsidered and it was shown that in the usual proofs assuming invariance under both space inversion and time reversal the former assumption was unnecessary provided that in the polarization experiment only components perpendicular to the final relative momentum are observed, and that in the asymmetry experiment the beam is polarized transversely to the initial relative momentum. It was then stated that the presence of a longitudinal component of initial polarization would not affect the asymmetry. This is incorrect because in the absence of parity conservation, beams polarized by scattering would in general have such longitudinal components. A method is suggested to overcome this difficulty. (W.D.M.)

11134

SOME CONSIDERATIONS ON THE HIGH-ENERGY ELECTRON-PROTON SCATTERING AND THE NUCLEON MASS DIFFERENCE. Kichiro Hiida and Makoto Sawamura (Univ. of Hiroshima). Progr. Theoret. Phys. (Kyoto) 18, 451-61(1957) Nov.

The recent high-energy electron-proton scattering experiments at Stanford are analyzed in connection with the small mass difference of the nucleon. If nucleons are rigid bodies, then it is shown that a consistent interpretation is given when a finite size of the same order as those of nucleons is ascribed to the electron. Discussions of this result are extended to other related phenomena. (auth)

11135

ANGULAR CORRELATION OF INTERNAL BREMSSTRAHLUNG AND SUCCESSIVE NUCLEAR GAMMA-RAY IN THE RADIATIVE K-CAPTURE. Yujiro Koh and Osamu Miyatake (Osaka City Univ.) and Yoiti Watanabe (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 18, 663-5(1957) Dec.

A method is given for calculating the characteristics of the capture process. The method is applied in calculating the constants for a unique first forbidden radiative K-capture in Y^{88}. (D.E.B.)

11136

ON THE DIFFUSION OF CHARGED PARTICLES IN A UNIFORM ELECTROMAGNETIC FIELD. Kh. Ya. Khristov (Sofia State Univ. and Lomonosov Moscow State Univ.). Soviet Phys. (Doklady) 2, 437-41(1957) Sept.-Oct.

11137

SCATTERING OF SLOW NEUTRONS BY DIATOMIC MOLECULES. A. A. Ansel'm (Leningrad Physico-Tech. Inst., Academy of Sciences, USSR). Soviet Phys. JETP 6, 480-5(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3368.

11138

RESONANCE SCATTERING OF γ-RAYS. N. A. Burgov. Soviet Phys. JETP 6, 502-5(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3159.

11139

SCATTERING OF ELECTRONS BY PROTONS. A. I. Akhiezer, L. N. Rozentsveig, and I. M. Shmushkevich. Soviet Phys. JETP 6, 588-94(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3369.

11140

GREEN'S FUNCTION FOR DIFFUSION OF RADIATION. B. A. Veklenko (Moscow Energy Inst.). Soviet Phys. JETP 6, 629-31(1958) Mar.

It is shown that by assuming that the mean free time of a photon is small compared to the duration of the excited state and by treating the diffusion of radiation in an infinite medium, one can obtain an analytic expression for Green's function f(r,t) of the diffusion of resonance radiation. (J.S.R.)

11141
APPLICATION OF CHARGE INVARIANCE TO POLARIZATION PHENOMENA. S. M. Bilen'kii (Joint Inst. for Nuclear Research). Soviet Phys. JETP 6, 633-4(1958) Mar.

A method for finding the relations involving polarization which follow from charge invariance is presented. On the assumption that the isotopic spin is conserved, the experimentally observed quantities are summed over their components to obtain the relation desired. The special case of the scattering of π mesons by nucleons is considered. (J.S.R.)

11142
EFFECT OF DAMPING ON POLARIZATION OF DIRAC PARTICLES IN SCATTERING. A. A. Sokolov and B. K. Kerimov (Moscow State Univ.). Soviet Phys. JETP 6, 639-40(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3371.

11143
DIFFERENTIAL ELASTIC SCATTERING CROSS SECTIONS FOR 14-Mev NEUTRONS. Hendrik Nauta. 'S-Gravenhage, Excelsior, [1957]. 74p.

The differential elastic scattering cross sections of lead, mercury, tungsten, antimony, selenium, and zinc for 14-Mev neutrons from the $T(d,n)He^4$ reaction in the angular range from 15 to 90° have been measured. Ring-shaped scatterers and a small spherically shaped detector are used for the measurements. In addition to a very pronounced maximum in the forward direction, the angular distributions of the elastically scattered neutrons show maxima and minima, which tend to smaller angles for heavier nuclei and larger neutron energy. (W.D.M.)

11144
SOME ASPECTS OF THE THEORY OF ELASTIC SCATTERING OF SPIN 0 AND OF SPIN ½ PARTICLES BIJ [BY] SPIN 0 TARGETS. Riek van Wageningen. 'S-Gravenhage, Excelsior, [1957]. 87p.

The problem of the derivation of phase shifts from experimental data is considered in detail. Only particles of spin 0 and ½ scattered by spin 0 targets and at one particular value of the bombarding energy is considered. A discussion on the drawing of conclusions from the phase shifts is presented. The assumptions which must be made so that the scattering may be described by phase shifts are rather general. The interaction is assumed to be spherically symmetric and to be invariant for the reversal of the direction of motion and reflection in space. Parity conservation is assumed throughout. In most cases it is convenient to assume that the interaction becomes sufficiently small at large distances. (W.D.M.)

Radiation Effects

11145 57-GL-206
General Electric Co. General Engineering Lab., Schenectady, N. Y.
THE EFFECTS OF NUCLEAR RADIATION ON ELECTRONIC TRANSFORMERS AND TRANSFORMER MATERIALS IN HIGH AMBIENT TEMPERATURES. J. C. Fraser. May 1957. 16p. Contract AF33(616)-3623.

Transformers and transformer materials were tested in the Brookhaven National Laboratory graphite reactor in an environment of thermal neutrons and fast neutrons. Three tests were carried out in an ambient temperature of 500°C; the first designed to test the radiation tolerance of materials; the other two tested transformers. (auth)

11146 NP-6766
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
MONTHLY ACCESSION LIST NO. 11 [ON RADIATION EFFECTS DATA]. May 15, 1958. 25p. Project No. 2133. Contract AF-33(616)-5171.

11147 RDB(W)/TM-1226
United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.
A NOTE ON THE COLLECTION AND ANALYSIS OF THE GAS CONTAINED IN IRRADIATED CARTRIDGES. J. C. Bates. [1955?]. Decl. Apr. 18, 1958. 7p.

Gas released during the decanning of cartridges in the Windscale pond was collected, and the results of the analysis of the samples collected are given. The large volumes of hydrogen found led to the development of a method of sampling the gas directly from the cartridge cans, which has shown that the hydrogen was not present as gas in the cartridge after irradiation but resulted from the decanning. Analyses of the latter samples are also given. (auth)

11148 REIC-5
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
THE EFFECT OF NUCLEAR RADIATION ON STRUCTURAL METALS. B. C. Allen, A. K. Wolff, A. R. Elsea, and P. D. Frost. May 31, 1958. 40p. Project No. 2133. Contract AF33(616)-5171.

The general effects of various types of radiation on metals are discussed and the damage mechanisms are outlined. Following this is a topical discussion of the effects of fast neutrons on the physical and electrical properties and corrosion resistance of metals. Tabular data are presented on these effects. Experimental evidence to date indicates that structural metals are quite resistant to nuclear radiation when compared to such things as organic compounds or electronic components. Fast neutrons in integrated flux levels above 10^{19} nvt represent the only reactor radiation that can significantly affect the properties of structural nonfissionable metals. (auth)

11149
RADIATION DAMAGES IN METALS AND SEMICONDUCTORS AFTER γ-IRRADIATION. S. Yu. Atomnaya Energiya 3, 562(1957).

The effects of gamma radiation on germanium and copper were investigated. The germanium was irradiated in the temperature range from liquid nitrogen temperature to room temperature. The irradiation of n-Ge causes a decrease of the "carrier number." After a long irradiation n-Ge is converted into p-Ge. An investigation of the temperature dependence of the Hall effect showed that two acceptor levels are formed in the n-Ge. One is 0.2 ev lower than the conductivity band and the other is 0.26 ev higher than the limit of the valence band. The irradiation of p-Ge causes a decrease of the concentration of "holes." Irradiating a copper monocrystal for 50 hours at room temperature with a gamma intensity of 4×10^{19} γ/cm^2 sec raises Young's modulus from $\sim 6.83 \times 10^{11}$ dynes/cm² to $\sim 7.348 \times 10^{11}$ dynes/cm². The defects appearing under gamma radiation are evenly distributed within the mass of the sample, which makes it possible to estimate the influence of the defects on different physical properties. (J.S.R.)

11150

BIREFRINGENCE IN NEUTRON-IRRADIATED BORON GLASS. C. Mylonas and R. Truell (Brown Univ., Providence, R. I.) and P. W. Levy (Brookhaven National Lab., Upton, N. Y.). J. Appl. Phys. 29, 864-5(1958) May.

Samples of boron glass were irradiated (slow flux approximately 2×10^{12} nv) in the Brookhaven Reactor for studies of the resulting ultrasonic attenuation and velocity changes. The plates invariably cracked after about an hour's irradiation; after irradiation for several hours they fell to pieces. Examined in polarized light incident normally on their largest faces, the plates showed little birefringence, but in an end-to-end viewing they exhibited relative retardation of several wave lengths. The disappearance of the birefringence in the neighborhood of certain stress-relieving cracks proved that the birefringence was caused by mechanical stress. There was evidence that the stress was tensile near the surface and compressive at the center. The dependence of the contraction on neutron flux can provide new information on the damage produced by energetic heavy particles in the interior of a solid and is the object of further investigation. (A.C.)

11151

EFFECTS OF NEUTRON IRRADIATION ON METALS AND ALLOYS. A. H. Cottrell (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Brit. Nuclear Energy Conf. 3, 50-67(1958) Jan.

The behavior of metals and alloys under neutron irradiation in a reactor is investigated. An explanation of how damage originates from the collision and absorption of neutrons by nuclei, and a description of the behavior of the fast ions, produced from these neutron encounters, as they penetrate the surrounding material are given. The estimated amount of damage is compared with measured values. Annealing of the damage in which displaced atoms gradually migrate back into lattice positions under the action of thermal agitation is discussed. The effects of irradiation on the mechanical properties of metals and alloys are discussed. Radiation growth in uranium and the effects of irradiation on the corrosion resistance of metals are discussed. (W.D.M.)

11152

RESISTANCE OF INDUSTRIAL GLASS AGAINST THE EFFECT OF GAMMA RAYS. S. M. Berkhovskikh. Steklo i Keramika No. 1, 10-14(1958). (In Russian)

The resistivity of various types of industrial glass to the effects of gamma radiation was studied. The light transparency of the glasses was determined before and after irradiation. The color characteristic of the glasses was also determined. The results obtained are tabulated. (J.S.R.)

Radioactivity

Refer also to abstract 10328.

11153

ON THE PROBLEM OF THE DEFINITION OF ROENTGEN IN THE RECOMMENDATION OF THE INTERNATIONAL COMMISSION FOR RADIOLOGICAL UNITS (1953). S. N. Ardashnikov and N. S. Chetverikov. Atomnaya Energiya 3, 238-44(1957).

The definition of roentgen (r), which was worked out at Stockholm in 1928 and at Chicago in 1937, was examined again in 1953, and a new definition was decided upon. This new definition still has the disadvantage that one roentgen is measured by the "amount of x or gamma radiation." This "amount" is open to various interpretations. In order to eliminate any ambiguity it was suggested that a new international definition which takes the following into account should be decided upon: (1) What is being measured by a roentgen: the ionizing effect of radiation, the ionization amount, or the amount of energy? (2) If the amount of energy is to be measured, then what energy is meant: incident energy, or the energy that must be used for corpuscular emission, or the energy that is absorbed in the course of ionization and excitation? (3) Is the absolute amount measured or is it referred to the mass, the volume, or the surface? (4) If reference is made to mass of a volume, then what mass and what volume: the irradiated volume in which the corpuscular emission is caused, or the ionized volume in which ionization or excitation took place? (TCO)

11154

ANGULAR DISTRIBUTION AND EFFECTIVE CROSS SECTION OF THE REACTION $Li^7(p,\alpha)\alpha$ BELOW 600 kev. Bernd Conrad, Volker König, and Uwe Timm. Naturwissenschaften 45, 204-5(1958). (In German)

The measurement of the angular distribution and effective cross section for the reaction $Li^7(p,\alpha)\alpha$, briefly described earlier (Timm, Naturwissenschaften 9, 279(1957)), was repeated using improved measuring apparatus and different measuring techniques. The excitation function was measured with a scintillation counter and CsI crystals between proton energies of 125 and 600 kev. The asymmetry (defined as $A + B = N(0,E)/N(90,E) - 1$) and the effective cross section increase with increasing proton energies. (J.S.R.)

11155

β^+-DECAY OF Ho^{160}. B. S. Dzhelepov, O. E. Kraft, and B. K. Preobrazhenskii (M. V. Lomonosov Leningrad State Univ.). Soviet Phys. (Doklady) 2, 450-2(1957) Sept.-Oct.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 5754.

11156

SCINTILLATION COINCIDENCE STUDIES OF THE DECAY OF Hf^{181} AND Os^{193} AND THE ISOMERISM IN ODD PROTON NUCLEI. Hendrik de Waard. 'S-Gravenhage, Excelsior, [1957]. 111p.

A discussion of some of the arguments that can be put forward to explain the scarcity of long lived isomers in the region Z = 58 to 82 and remarks about the short lived isomeric states observed there are presented. A description is given of coincidence measurements performed on the β-active nuclei Hf^{181} and Os^{193}. In the decay of these isotopes short lived isomeric states have been found, ascribed to the odd-Z nuclei Ta^{181} and Ir^{193}. These elements were chosen because from their disintegration schemes information can be obtained about the relative position of the lower levels. Attention is given to the experimental methods, especially to the electronic measurement of short time intervals and the analysis of the behavior of high resolution delayed coincidence circuits. (W.D.M.)

Rare Earths and Rare-earth Compounds

11157

RADIOCHEMICAL INVESTIGATION OF PRODUCTS RESULTING FROM A DIVISION OF LANTHANUM BY 660 Mev ENERGY PROTONS. A. K. Lavrukhina, L. D. Krasavina, and A. A. Pozdnyakov, (Vernadskii Inst. of

Geochemistry and Analytical Chemistry). Doklady Akad. Nauk S.S.S.R. 119, 56–8(1958) Mar. 1. (In Russian)

According to the experimental data and calculations of the cross sections the fission of lanthanum results in formation of isotopes with surplus neutrons. The isotopes are distributed over a wide range of atomic numbers from Z = 15 to Z = 40. The yields from fission of lanthanum by 660-Mev protons distributed according to their atomic number are shown graphically. The diagram indicates the probability of symmetric and asymmetric fission. Some of the fragments have cross sections from 10^{-30} to 10^{-28} cm^2. The total cross section is equal to 0.6×10^{-27} cm^2, which is in good agreement with the cross sections of fission of rhenium, tantalum, and holmium by 450-Mev protons. (R.V.J.)

11158

HYPERFINE STRUCTURE OF SPECTRAL LINES OF HOLMIUM. V. B. Belyanin. Optika i Spektroskopiya 3, 322–7(1957). (In Russian)

A diffraction grating spectrometer (600 lines/mm and first-order dispersion of 4 A/mm) connected with a Fabry-Perot etalon was used to obtain the spectrum of holmium. Distances between the hyperfine structure components and total hyperfine structure widths were measured. 70 spectral lines in the region 3400 to 6500 A were studied. In 32 of them eight components were clearly visible. The remaining lines were incompletely resolved. Usually the separations and intensities of the hyperfine components decrease towards longer wavelengths. A comparison of the holmium hyperfine spectrum with that of praseodymium showed that the two are similar. It was concluded that the spectrum of Ho II lies in the short wavelength region, while that of Ho I lies in the long wavelength region. The boundary between the two regions is between 4000 and 4200 A. The intense Ho lines observed were probably caused by transitions to the ground state. From the fact that the resolved lines have eight components, it follows that the quantum numbers J of the intense lines have values J > I = ½. As it has been shown that the v lines of Pr are caused by inversion of the hyperfine structure of the lower levels and since the hyperfine structure of Ho and Pr are qualitatively similar, it was assumed that the v lines in Ho are also caused by inversion of the hyperfine structure of the lower levels. (J.S.R.)

11159

ISOTOPIC SHIFT IN THE SPECTRUM OF CERIUM. L. A. Korostyleva. Optika i Spektroskopiya 3, 536–44 (1957). (In Russian)

The isotopic shifts between the components of isotopes $Ce^{137}-Ce^{138}-Ce^{140}$ were determined. In addition an attempt was made to study in greater detail the isotopic shift of the spectrum of cerium between the components of the isotopes $Ce^{140}-Ce^{142}$ and to determine from the isotopic shift the possible electron configurations of the levels taking part in energy transitions. The experimental set up was as follows: The source of light was an aluminum tube with a hollow cathode cooled by liquid air. A Fabry-Perrot interferometer served as the high resolution instrument and was used in conjunction with a 3-prism Zeiss spectrograph (focal distance of the camera 84 cm). The coefficient of reflection of the silver coatings was about 90% in the region 4000 to 4500 A. The specimen was in the form of a cerium salt solution deposited on the hollow cathode and evaporated. The cerium spectrum was excited in a krypton atmosphere at a pressure of 1 mm Hg. The exposure was between 1.5 and 2 hours with a current of 100 ma. Kodak F-III films were used to photograph the spectra between 4000 and 6500 A. Three specimens were used to obtain the isotopic shift: natural mixture of cerium isotopes, 50% mixture of isotopes of Ce^{140} and Ce^{142}, and an enriched cerium specimen consisting of 20.6% Ce^{136}, 14.5% Ce^{138}, 61.8% Ce^{140}, and 3% Ce^{142}. The spectrograms were taken with 20, 30, and 40 mm between the plates of the etalon. The isotopic shift was measured between components of isotopes Ce^{140} and Ce^{142} for 102 lines. All cerium lines have a negative shift. In four lines of enriched cerium the shift between the components of the isotopes $Ce^{136}-Ce^{138}-Ce^{140}$ was determined by a graphical method and it was found that its magnitude is 0.26 of the shift between the components of the isotopes $Ce^{140}-Ce^{142}$. The results obtained are summarized. The experimental results established the existence of an anomaly in the isotopic shift in the spectrum of cerium between isotopes whose nuclei consist of 82 and 84 neutrons. It is concluded that in a transition from the isotope having 82 neutrons to the isotope having 84 neutrons, a completion of a shell occurs. The observed jump in the isotopic shift between the composition of the isotopes $Ce^{140}-Ce^{142}$ appears to be a result of a sharp increase in the nuclear radius and a change in the charge distribution in the nucleus of the isotope with 84 neutrons. (TCO)

11160

PARAMAGNETIC RESONANCE IN SOME LANTHANON ETHYL SULPHATES. J. M. Baker (Univ. of Oxford) and B. Bleaney (Columbia Univ., New York). Proc. Roy. Soc. (London) A245, 156–74(1958) June 3.

Paramagnetic resonance in rare earth ions with an even number of unpaired $4f$ electrons is discussed with particular reference to experimental results in Pr^{3+}, Tb^{3+}, and Ho^{3+} ions in single crystals of the ethyl sulfates. The crystal field theory of Elliott & Stevens is used to interpret the results. Some second-order perturbation mechanisms are considered which give rise to apparent quadrupole and hyperfine structure interactions. The following nuclear data are obtained from these experiments: Pr^{141}: $I = 5/2$; $|\mu| = 3.92 \pm 0.2$ n.m.; Tb^{159}: $I = 3/2$; $|\mu| = 1.52 \pm 0.08$ n.m.; Ho^{167}: $I = 7/2$; $\mu = +3.29 \pm 0.17$ n.m.; $Q = +0.7 \pm 0.7$ b. (auth)

11161

THE PHASE DIAGRAM FOR CERIUM. A. I. Likhter, Yu. N. Ryabinin, and L. F. Vereschagin (Very High Pressure Lab., Academy of Sciences, USSR). Soviet Phys. JETP 6, 469–71(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3403.

Shielding

11162 AERE-T/R-2507

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

NEUTRON ATTENUATION IN CONCRETE. K. T. Spinney. Feb. 1955. 15p. $0.45.

Declassified version of AERE-T/R-1617; SWP/P-21.

The observed behavior of the penetrating neutrons in a concrete shield is accounted for by a simple theory making use of a calculated 'transport' cross section for fast neutrons. This method is then linked with conventional age theory in an empirical manner so that a good fit is obtained to the observed neutron attenuation at all distances in the shield. (auth)

Spectroscopy

11163

SPECTROSCOPIC ANALYSIS OF SMALL ACTINIUM SAMPLES. N. I. Kaliteyevskiy and A. N. Razumovskiy. Atomnaya Energiya 3, 548-50(1957).

The optical spectrum of actinium was measured from 2726.3 to 4034.5 A, and 54 lines and their intensities are tabulated. (J.S.R.)

11164

ON THE CALCULATIONAL PROCEDURES IN THE DERIVATION OF THE VIBRATIONAL TRANSITION PROBABILITIES OF THE FIRST NEGATIVE ($b^4\Sigma^-_g \rightarrow a^4\Pi_u$) BANDS OF O_2^+. N. R. Tawde and N. Sreedhara Murthy (Karnatak Univ., Dharwar). Indian J. Phys. 32, 128-32(1958) Mar.

Recently, Rao and Ranade published some calculations of vibrational transition probabilities of the bands of O_2^+ (first negative) system. A study of that paper revealed two errors in the calculations and in the usage of the methods applied. The first error is due to the wrong usage of mathematical technique of Manneback for the calculation of vibrational transitional probabilities, and the other error is in the interpretation and derivation of transition probabilities by the application of the method of Manneback and Rahman. (auth)

11165

INFRARED SPECTRUM OF $Ca(OH)_2$. W. R. Busing and H. W. Morgan (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 28, 998-9(1958) May.

The results of an infrared study of $Ca(OH)_2$ single crystals at room temperature and at liquid nitrogen temperature are reported. (J.E.D.)

11166

A TWO-CRYSTAL NEUTRON SPECTROMETER. V. N. Bykov, S. I. Vinogradov, V. A. Levdik, and V. S. Golovkin. Kristallografiya 2, 634-8(1957). (In Russian)

The Soviet atomic pile used for power generation will provide a flux of 2×10^{13} neutrons/sec cm^2 which can be used for diffraction. A 5-m steel tube emerges through the shielding and provides a naturally collimated beam of 24′ divergence. The integrated thermal neutron flux falling on the monochromator is 10^7 neutrons/cm^2 sec. The monochromatization is by reflection from the 200 plane of a lead crystal $135 \times 55 \times 22$ mm. The half width of the reflected beam is usually 37′ corresponding to an energy uncertainty of 9%. There may also be 2.5% diffusely scattered neutrons. After monochromatization the flux is about 10^4 neutrons/cm^2 sec. The lead crystal which is behind 80 cm of concrete can be moved in any required direction to direct the beam down the final collimator which is made of paraffin and boron carbide. The apparatus is more properly called a diffractometer as the reflected intensities are measured on a boron trifluoride counter and recorded as in x-ray diffractometry. The specimen counter distance is 20 to 100 cm. Angles can be measured on a 110 cm diameter circle to 2′. A specimen to counter rotation ratio of 1 : 2 is provided. The counter has a diameter of 2 cm and a length of 27 cm; it is filled to 700 mm Hg with BF_3 enriched in B^{10}. A test crystal of KBr of dimensions $6 \times 6 \times 8$ mm gave peak counts of 3100/min (200 reflection) with a uniform background of about 100/min and very satisfactory resolution. An iron rod (8 mm diam) which was polycrystalline, gave peaks of 200/min with a background of 20/min. (TCO)

11167

INCREASE OF THE APERTURE POWER OF A LENS SPECTROMETER BY A TRANSVERSE MAGNETIC FIELD. V. A. Sergiyenko. Pribory i Tekh. Eksp. No. 4, 13-15(1957).

The results of experiments designed to increase the aperture power of a magnetic lens β-spectrometer by using an auxiliary toroidal magnetic field are described. The form of the auxiliary field was found experimentally. The aperture power was increased 3 times without worsening the resolution. The half-width of the line for an 8° divergence angle of the electron beam was 3.4%. The distance of the 5 mm source from the counter was 125 cm. A magnetic lens of length 30 cm was situated between the source and the counter. The maximum divergence angle was 8° (between angles of emission 13 to 5° with respect to the spectrometer axis). Two diaphragms to restrict the beam were placed in the trajectory of the electrons at distances of 48 and 80 cm from the source. The correcting action of the auxiliary cross magnetic field on the focussing was studied for divergence angles of 2, 4, 6, and 8° and with counter windows of 3 to 12 mm diam. The current strength in the correcting coil was changed proportionally to the current in the lens. The F conversion line of ThB was studied for each divergence and for different windows. The half-width and shape of the conversion line and also the number of counts per min. at its maximum for different current strengths in the correcting coil were investigated and are presented graphically. The directional properties of correcting systems of trapezoidal and triangular forms were studied. Best results were obtained with a system consisting of 16 flat, triangular coils of height 12 cm and 17 cm base, having 25 turns. The windings were disposed with their vertices to the axis and placed 36 cm from the source. With a 17 : 1 ratio of the ampere-turns of the lens to the ampere-turns of the correcting system, the shape of the line was not distorted up to angles of divergence of 8°. The aperture power for this angle of divergence was 2% of the total solid angle. (TCO)

11168

STABILIZATION OF THE MAGNETIC FIELD IN MAGNETIC SPECTROMETERS. Yu. S. Yegorov, G. D. Latyshev, and Yu. I. Trulev. Pribory i Tekh. Eksp. No. 5, 41-6(1957). (In Russian)

An instrument is described which uses the phenomenon of nuclear proton resonance to stabilize the magnetic field in a beta spectrometer. The stable point of operation may be chosen anywhere in the range 140 to 1400 gauss. The degree of stabilization is approximately 2×10^{-5} for fields greater than 300 gauss and 4×10^{-5} for fields greater than 140 gauss. For fields up to 940 gauss, the coil is a toroid of volume 13 cm^3 and Q-value about 70. The circuit of the amplifier bridge, l.f. amplifier, phase-detector, and d-c amplifier are given. The equipment was used over a period of four months for investigating the electron spectrum of RaTh in the range 140 to 2600 kev. The stabilization coefficient of the circuit against changes in the current in the main field coil is 100. The main field was supplied from accumulators and had a drift rate of 0.01%/sec in current. The dominant time constant in the feedback circuit was 5 sec. A note added in proof reports that the lower limit to the field which can be stabilized has recently been reduced to 12 gauss, while measurements may extend down to 5 gauss. (TCO)

11169

SPECTROSCOPY WITH ORIENTED NUCLEI. AN INVESTIGATION ON THE DECAY OF Co^{56}. Albert Nomdo Diddens. 'S-Gravenhage, Excelsior, [1957]. 109p.

Measurements of the angular distribution and the linear polarization of the gamma rays emitted by oriented Co^{56} nuclei are described. Conclusions are made about the multipole order of the gamma transitions and about the spins and parities of the excited levels in the daughter nucleus Fe^{56}. A brief survey is given of the methods of orientation of nuclei at low temperatures and of the experimental detection of this orientation. The problem of the analysis of a gamma spectrum, as obtained with a scintillator, into its components is treated. The method for the determination of the degree of linear polarization from the cross section for Compton scattering is described. A description of the polarimeter used for gamma rays up to 3.25 Mev and data about the detection efficiency, the energy resolution, and the performance are given. (W.D.M.)

Theoretical Physics

11170 AFOSR-TN-58-411
Stanford Univ., Calif.
FORM FACTORS IN QUANTUM ELECTRODYNAMICS. Technical Report No. 31. S. D. Drell and F. Zachariasen. May 1958. 38p. Project No. 3750-37504. Contract AF18(600)-545. (AD-158214).

The electromagnetic form factors of an electron in pure quantum electrodynamics (QED) are analyzed with the techniques of dispersion relations. The viewpoint is adopted that no subtractions are required in the construction of dispersion relations for the electromagnetic vortex. This leads to coupled integral equations for the form factors in terms of other physical amplitudes: electron-positron scattering, for example. The relation between this and the usual perturbation approach to QED and the validity and consequences of the "no subtraction" philosophy are discussed. (auth)

11171 AFOSR-TN-58-412
Stanford Univ., Calif.
PC CONSERVATION IN STRONG INTERACTIONS. Technical Report No. 30. S. D. Drell, S. C. Frautschi, and A. M. Lockett, III. May 1958. 8p. Project No. 3750-37504. Contract AF18(600)-545. (AD-158215).

Gupta's considerations of parity-charge conjugation (PC) are extended to include charged mesons, hyperons, and K mesons. Experimental complications in the application of the PC selection rule to strong interactions are also considered. (D.E.B.)

11172 CERN-58-7
European Organization for Nuclear Research, Geneva.
THE DENSITY MATRIX. R. Hagedorn. Apr. 1, 1958. 52p.

Lectures given to the experimental physicists at CERN.

Representations and transformation theory in Hilbert space are dealt with. In the treatment of states which are not pure, the density matrix is introduced and its properties are given. The use of the density matrix is demonstrated in the following examples: in thermodynamics, polarization of a particle beam, polarization of light, and an idealized experiment (Fano). (M.H.R.)

11173 LAMS-2199
Los Alamos Scientific Lab., N. Mex.
AN UNCONDITIONALLY STABLE, FINITE DIFFERENCE METHOD FOR PHOTON TRANSPORT PROBLEMS. Burton Wendroff. Mar. 1958. 13p. Contract W-7405-eng-36. $0.50(OTS).

An unconditionally stable, finite difference method for solving photon transport problems is described and tested on a simple one-dimensional problem using a variety of mesh sizes. (auth)

11174 NP-6717
Pittsburgh. Univ. Sarah Mellon Scaife Radiation Lab.
PRECISION SCATTERING OF NUCLEAR PARTICLES. THE NUCLEAR SHELL MODEL—I. Technical Report No. IX, Part I. J. B. French. Mar. 1958. 173p. Project No. NR022-068. Contract N7onr-32505.

Some of the theoretical techniques useful in particular angular momentum coupling and tensor operators are considered. Several definitions are listed, and the properties of nuclear interactions are considered. The energy levels and eigenfunctions of the S^4P^2 configuration for A = 6 are considered in detail. Some of the essential features of many-particle symmetry are reviewed. A survey of the general level structure of the entire p shell is presented. (W.D.M.)

11175 NP-tr-84
EQUATIONS FOR THE GREEN FUNCTIONS IN QUANTUM ELECTRODYNAMICS. J. Fischer. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1957. 24p. (Translation partially illegible.)

Using the Freese-Matthews-Salam equations for chronological products of field operators, equations for Green functions of many electrons and photons are written. It is shown that for finding any single Green function an infinite recursive system of these equations is to be solved. This system is reduced, after adding terms containing the external electric current and external electromagnetic potential to the Lagrangian, to one equation containing functional derivatives of higher orders. It is shown that all relations and equations become much simpler when the definition of the Green function is appropriately changed. (auth)

11176 NP-tr-85
RELATIVISTIC THEORY OF REACTIONS INVOLVING POLARIZED PARTICLES. Chou Kuang Chao and M. I. Shirokov. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1957. 23p. (Translation partially illegible.)

It is shown that the relativistic formulas for angular distribution, for polarization vectors and tensors in the reaction of $a + b \rightarrow c + d$ type in its rest system coincide mainly with the nonrelativistic ones if the spin of the particle is determined as the intrinsic angular momentum of the particle with respect to its center of inertia. The square of this intrinsic angular momentum is the Lorentz invariant. Spins of the particles are arbitrary and they have non-vanishing rest masses. The main difference from the nonrelativistic case is that the description of the spin state is not identical in different Lorentz systems. Therefore, it is necessary to introduce the corrections into the nonrelativistic formal theory of the cascades of the reactions. The relativistic changes in the angular correlations in the cascades of the type $\pi + p \rightarrow Y + K$, $Y \rightarrow N + \pi$ (where Y is the Λ or Σ hyperon) are pointed out. (auth)

11177 NP-tr-97
ON INVERSIONS OF SPACE AND TIME. J. Rzewuski. Translated from a publication of the Joint Institute for Nuclear Research, U.S.S.R. 1957. 19p. (Translation partially illegible.)

The transformation properties of spinors and pseudospinors with respect to inversions of space and time are investigated in some detail. In particular, the various possible two-component theories are investigated. A

purely geometrical approach to the theorem of Luders and Pauli is pointed out. (auth)

11178

ANALYSIS OF NEUTRON-ELECTRON INTERACTION IN THE RELATIVISTIC PERTURBATION THEORY. Kin-ichi Ishida (Tohoku Univ., Sendai, Japan). Progr. Theoret. Phys. (Kyoto) 18, 493-502(1957) Nov.

Recent experiments indicate that the charge distribution of the physical neutron is almost neutralized by the cancellation of the nucleon core and the meson cloud charges, which can hardly be expected from the fixed-source theory. On the other hand, the relativistic ps-coupling theory, which indicates that both the nucleon core and the meson cloud spread out over the region of about twice the nucleon Compton wave length, seems to be more promising. In this paper, the effective neutron-electron potential is analyzed by perturbation theory, evaluating separately for each time-ordered graph so as to compare with the result of the fixed-source theory. It is found that (1) owing to the nucleon recoil effect, the p-wave meson contribution is only about 1/2.3 times the one in the fixed source theory; (2) the (–) energy state contribution for the nucleon core charge is as large as that of (+) energy state; and (3) s-wave meson contributions, which are not involved in the fixed source theory, are taken into account qualitatively. Thus the main discrepancy with experiments arises from the inadequate treatment in the fixed source theory, though a part of the yet remaining discrepancy might be explained by the modification of the quantum electrodynamics as has been discussed by Yennie et al. (auth)

11179

A NEW APPROACH TO A BOUND STATE. Tsutomu Imamura (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 18, 559-66(1957) Dec.

The extended wave matrix which generates not only the eigenvectors for scattering states but also those for bound states from those of the free Hamiltonian is introduced. By using this operator, the problems in the non-perturbation approach are discussed in a general fashion in the case of the system involving bound states. (auth)

11180

DESCRIPTION OF PAULI MATTER AS A CONTINUOUS ASSEMBLY OF SMALL ROTATING BODIES. Takehiko Takabayasi and Jean-Pierre Vigier (Institut Henri Poincaře, Paris). Progr. Theoret. Phys. (Kyoto) 18, 573-90(1957) Dec.

Kramer's method of representing a two-component spinor is revised and developed into a consequent formulation of the quantum mechanical theory of a non-relativistic spinning particle. The method is unified with the hydrodynamical representation of the Pauli electron theory, giving the picture of the Pauli field as an assembly of very small rotating bodies (distinct from usual rigid bodies) continuously distributed in space. The formalistic and physical features of these new representations are considered. Some remarks are given on the characteristics of the former hydrodynamical formulation. Particularly it is pointed out that Planck's constant enters this scheme only as the constant signifying the magnitude of the spin. (auth)

11181

ON THE THEORY OF THE UNSTABLE PARTICLE. II. Kunio Naito (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 18, 614-20(1957) Dec.

A model for studying the theory of the unstable particle is proposed. In this model, the decayed particles are distinguished from the parental ones. The production and decay of an unstable particle is investigated by the stationary treatment. It is concluded that it is possible to interpret the renormalization constant as the probability in the same way as in the case of the stable particles. (auth)

11182

RADIATION FROM CHARGED PARTICLES PASSING NEAR A PERFECT CONDUCTOR. Yu. N. Dnestrovskii and D. P. Kostomarov. Soviet Phys. (Doklady) 2, 442-6 (1957) Sept.-Oct.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 4544.

11183

BOUND STATES IN POSITRONIUM. Yu. A. Tarasov (Moscow State Univ.). Soviet Phys. JETP 6, 542-4 (1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3436.

11184

CONCERNING SUPERPOSITIONS WITH RESPECT TO THE INTERNAL PROPERTIES OF ELEMENTARY PARTICLES. M. I. Podgoretskii (Joint Inst. for Nuclear Research). Soviet Phys. JETP 6, 607-8(1958) Mar.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3437.

11185

VVEDENIYE V TEORIYU KVANTOVANNYKH POLEY. (Introduction to the Theory of Quantum Fields.) Nikolay Nikolayevich Bogolyubov and Dmitriy Vasil'yevick Shirkov. Moscow, Gosudarstvennoye Izdatel'stvo Tekhniko-Teoreticheskoy Literatury, 1957. 442p. (In Russian)

A systematic presentation is given of the development of the theory of quantum fields, from its basic principles to its latest achievements, with emphasis on mathematical accuracy and on reporting the latest, most promising trends. The book is intended primarily for the benefit of students beginning the study of the quantum field theory and for theoreticians already working in this branch of physics. 107 references. (J.S.R.)

Uranium and Uranium Compounds

11186 CRMet-752

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

DETERMINATION OF THE DENSITY OF ACTIVE URANIUM. G. R. Piercy. Mar. 1958. 14p. (AECL-572). $0.50(AECL).

A procedure was found to measure the density of irradiated uranium to an accuracy of 0.06% by measuring the weight of the sample in air and in n-octyl alcohol. The measurements were made using a gramatic balance that was readily adapted for remote control in the "cave." Since the n-octyl alcohol was inside the balance for all measurements, the complete apparatus was mobile. (auth)

11187

THE SPECTRUM OF NEUTRONS INELASTICALLY SCATTERED BY U^{238}. N. I. Fetisov. Atomnaya Energiya 3, 211-14(1957).

By means of a Wilson chamber the spectrum of the scattered neutrons was recorded. A target of "heavy"

ice was used as a neutron source, which was bombarded with accelerated deuterons. The average energy of the primary neutrons was 2.5 and 3.5 Mev. As a scattering substance a spherical uranium layer of 18-mm thickness was used, where the target center coincided with the scattering center. The energy distribution of the inelastically scattered neutrons—measured in the interval range of from 100 to 1300 kev—can be represented by the statistical theory. For the 2.5 Mev primary neutrons the most probable scattering energy of the secondary neutrons is 275 kev; for 3.5 Mev neutrons it shifted toward 375 kev. (TCO)

11188

X-RAY EXAMINATION OF IRRADIATED URANIUM WHEN STUDYING ITS GROWTH UNDER IRRADIATION. I. V. Batenin and B. V. Sharov. Atomnaya Energiya 3, 261-2(1957).

Many samples of natural uranium and 2% enriched uranium, which had been irradiated in a reactor fuel for the same period at the same temperature, were subjected to x-ray examination. It was found that the samples were not homogeneous because of the variation in the production methods. Only the different degree of texture in the casting can serve as a measure for the different growth rates during irradiation. (J.S.R.)

11189

INTEGRATION OF THE FISSION NEUTRON SPECTRUM OF U^{235}. K. Yu. Atomnaya Energiya 3, 269-70(1957).

A solution of the integral $N(a \rightarrow b) = \int_a^b N(E)dE \int_a^b A_1^{-E} \operatorname{sh} \sqrt{2E}\, dE$ is given in mathematical form. The part of the fission neutron, the initial energy of which is located between a and b, is therefore computed. (TCO)

11190

PRODUCTION OF ESPECIALLY PURE U^{233} AND U^{235} POWDERS. Z. G. Atomnaya Energiya 3, 270-1(1957).

A reaction apparatus is described by means of which 200 to 350 g batches of UO_2 powder can be obtained. The exact technological operation is given step by step. Because of the high α activity of U^{235} and U^{233} all operations must be carried out in closed rooms which are accessible only from the outside. A scheme for this operation is given. (TCO)

11191

THE DILATOMETRIC DETERMINATION OF THE COEFFICIENT OF EXPANSION OF α-URANIUM. Z. G. Atomnaya Energiya 3, 272(1957).

Pieces of uranium measuring 4 × 4 × 50 mm of different origins were heated for some minutes at a temperature higher than the α-β transformation temperature, and were then chilled in H_2O. They were annealed for several hours at a temperature of 600°C, and recrystallization took place. From these samples monocrystals were layered according to Cahn's method. They were dilatometrically investigated. The rate of heating up to a temperature of 630°C was to 150°C/h. The coefficients of expansion in the a,b, and c axes were measured for temperatures from 20° up to 250°, 325°, 400°, 475°, 350°, and 625°. The results were:

	250°C	625°C
$\alpha_a \times 10^6$	23.1	31.3
$\alpha_b \times 10^6$	−0.3	−7.5
$\alpha_c \times 10^6$	22.6	33.3

$V = (\alpha_a + \alpha_b + \alpha_c) \times 10^6$. (TCO)

11192

MEASUREMENT OF THE NEUTRON SPECTRUM IN THE AREA BELOW 0.5 Mev BY MEANS OF THE TIME OF FLIGHT METHOD. Yu. A. Vasil'yev, Yu. S. Zamyatnin, B. V. Toropov, and E. F. Fomushkin. Atomnaya Energiya 3, 542-4(1957).

By the use of an impulse source of neutrons the secondary neutron spectrum obtained by passing 14-Mev neutrons through layers of uranium was measured. A fission chamber connected with a 30-channel analyzer was used as a neutron detector. The distance between source and detector was 6 m. The energy spectrum was obtained for 2.7-cm layers of U^{235}, 2.5-cm layers of U^{238}, and 8-cm layers of U^{238}. The spectra obtained from the first two layers originate from a simple interaction between 14-Mev neutrons and the uranium nuclei. It can be assumed that, in the energy range measured, the secondary neutrons originate by evaporation from the excited compound core. In the last layer the production of a higher number of slow neutrons was observed. These are the results of a multiple inelastic interaction which confirms the existence of low-lying levels in the U^{238} nucleus. (J.S.R.)

11193

FISSION YIELDS OF SEVERAL HEAVY FISSION PRODUCTS OF U^{233}. R. N. Ivanov, V. K. Gorshkov, M. P. Anikina, G. M. Kukavadze, and B. V. Ershler. Atomnaya Energiya 3, 546-7(1957).

The absolute fission yields of U^{233} were determined by means of the isotope dilution method and from the integral concentrations obtained from mass spectrographic measurements. The sample was irradiated for two months. The following yields in % were measured:

Isotope	Isotope Dilution	Mass Spec.
Cs^{133}	5,2 ± 0,3	5,50 ± 0,13
Cs^{137}	5,8 ± 0,3	6,16 ± 0,14
Ce^{140}	5,45 ± 0,50	6,16 ± 0,24
Ce^{142}	5,5 ± 0,5	6,06 ± 0,24
Nd^{143}	5,0 ± 0,3	5,19 ± 0,17
Nd^{144}	3,8 ± 0,4	3,84 ± 0,15
Nd^{145}	2,82 ± 0,25	2,88 ± 0,08
Nd^{146}	2,20 ± 0,15	2,24 ± 0,07
Nd^{148}	1,03 ± 0,10	1,07 ± 0,04
Nd^{150}	0.51 ± 0,08	0,49 ± 0,02
Sm^{149}	0,66 ± 0,13	0,70 ± 0,03
$Sm^{151 + 152}$	0,60 ± 0,14	-- --
Sm^{151}	-- --	0,54 ± 0,03

The Xe^{135} absorption coefficient was determined to be $(3.2 \pm 1.0) \times 10^6$b. (TCO)

11194

INVESTIGATION OF LUMINESCENCE OF SODIUM FLUORIDE ACTIVATED WITH URANIUM. Z. M. Sverdlov. Optika i Spektroskopiya 3, 356-60(1957). (In Russian)

The luminescence and absorption of NaF—U systems were investigated for the purpose of developing a simple method for the determination of uranium. The NaF—U systems were prepared in the form of beads melted into the eye of a platinum wire. The beads were activated by immersion into an aqueous solution of uranyl nitrate and then remelting in a flame. The dependence of the luminescence intensity on the uranium content is shown. At small U concentrations the intensity increases with U content. Luminescence intensity reaches a maximum at 2.22×10^{-4} molecular proportion of U. With further increase of U content the luminescence intensity decreases, but the absorption in the visible region increases. It was concluded that the luminescence of NaF—U is of the "crystalline" type. Decay of the luminescence of NaF—U was studied. In the range from

10^{-4} to 1.4×10^{-3} sec, luminescence decay of NaF–U is a bimolecular process described by the formula $I = At^{-\alpha}$. The phosphorescence spectrum was obtained at room temperature 2×10^{-4} sec after excitation had ceased. The effect of Fe, V, Si, and Al impurities on the luminescence intensity was studied, and Fe was found to have a strong quenching effect. A simplified method of chemical treatment of rock samples in preparation for quantitative determination of U is described. (J.S.R.)

11195

A STUDY OF EMISSION AND ABSORPTION SPECTRA OF URANIUM. N. P. Penkin and S. E. Frish. Optika i Spektroskopiya 3, 473–9(1957). (In Russian)

Absorption and emission spectra of uranium were studied, using thermal excitation of uranium atoms in a King furnace in the temperature range 2800 to 3000°K. 167 emission lines and 47 absorption lines were observed. The uranium spectrum was photographed on a spectrograph in the region 2300 to 3800 A, and with an autocollimating spectrograph with a plane diffraction grating (50,000 lines) in the region 3800 to 6600 A. Spectrograms were taken in the 2nd order of the grating where the dispersion was approximately 5.5 A per mm. Uranium in the form of powder or filings was placed in a graphite tube of the furnace, after which it was evacuated and slowly heated. The spectra were photographed at temperatures between 2800 and 3000°K. The arc spectrum of iron was used for comparison. A Zeiss comparator was used for measurements on the photographs. The experiments were not successful at first because of the low vapor pressure of uranium. At such high temperatures as those above, uranium forms carbides, as a result of which its vapor pressure decreases. By replacing the graphite tubes with tantalum tubes or by separating the uranium from the graphite by tantalum the spectrum was successfully photographed. The results obtained are tabulated. Values of the wavelengths are taken from Harrison's tables. The studies confirmed the classification given by Kiess. It is concluded that uranium atoms do not have any levels lying deeper than $5_{L\frac{0}{6}}$. (TCO)

11196

THE EFFECTS OF PILE IRRADIATION ON U_3Si. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 18, Session 8. M. L. Bleiberg and L. J. Jones (Westinghouse Electric Corp., Pittsburgh). New York, American Institute of Chemical Engineers, 1958. 31p.

Specimens of U-3.8 wt.% Si alloy, heat treated to produce the epsilon intermetallic compound (U_3Si), were irradiated in the Materials Testing Reactor to a maximum exposure of 0.104 at.% burnup and at a maximum in-pile temperature of less than 250°C. The irradiation produced large changes in hardness, density, electrical resistivity, and mode of corrosion in 650°F water. The microstructure of the samples appeared unchanged, but no x-ray diffraction lines were observed after the irradiation. These results were tentatively explained on the basis of a neutron-induced disordering reaction. (auth)

11197

THE EFFECT OF TRANSFORMATION COOLING RATE ON THE ACTIVATION ENERGY REQUIRED FOR RECRYSTALLIZATION OF BETA QUENCHED URANIUM. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 17, Session 9. H. R. Gardner and J. W. Riches (General Electric Co., Richland, Wash.). New York, American Institute of Chemical Engineers, 1958. 22p.

A definite relationship was established between cooling rate from the beta phase and the activation energy required for alpha-phase recrystallization of uranium; as the cooling rate increases, the activation energy decreases. The phenomenon of introducing sufficient strain, by merely quenching, to cause subsequent recrystallization is rather unusual in metallurgical history. It is proposed that this process is characteristic of the anisotropic nature of alpha-phase uranium. The Avrami assumption of equivalent growth rates in the three crystallographic directions does not apply to the observed recrystallization phenomenon. Thus, the conclusion is reached that the theory should be extended to include anistropic metals. (auth)

PATENTS

Engineering

11198

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR ARRANGEMENTS. P. A. Lindley (to General Electric Co., Ltd.). British Patent 789,482. Jan. 22, 1958. Nuclear Power 3, 200(1958) Apr.

Hunterston is the only one of the new British nuclear power stations that is using centrifugal blowers for gas circulation and the reasons for General Electric's choice are put forward in this patent. Owing to the relatively small pressure rise needed across the blower in these plants only one stage is needed and the centrifugal type would seem to be very suitable. The static pressure is however very high and the normal type of diffuser scroll casing is considered fundamentally unsuitable to withstand this. The designers have therefore proposed to get over this difficulty, while retaining a centrifugal impeller, by installing the blower actually inside the boiler. By this means, the diffuser casing need only be capable of withstanding the differential pressure and can therefore be made in comparatively light material. The impeller and diffuser sections can be very large, thus contributing to efficiency. The invention also covers axial- and mixed-flow impellers.

11199

IMPROVEMENTS IN OR RELATING TO HEAT TRANSFER ARRANGEMENTS. D. A. Boyland (to General Electric Co., Ltd.). British Patent 790,688. Feb. 12, 1958. Nuclear Power 3, 298(1958) June.

A device for improving the heat transfer from finned fuel elements by arranging the coolant flow to be transverse to the element is presented. The coolant channel is in effect divided into two parts parallel to the elements, gas entering one part, passing over the fins and being led off through the other. It means that each part of the element is cooled by gas which has not been used for appreciable cooling in any other part of the element. Thus with the same total flow and inlet temperature of coolant a higher rate of heat transfer from elements in the central high-flux region of the core can be achieved. Another advantage is that heat is removed from the whole of the fin and not only the tips so that the elements can be run at a lower temperature for the same fin temperature. The degree of turbulence required in the coolant is not so high as with straight through flow and a lower powered blower can be used.

Physics

11200

NUCLEAR REACTORS. (to Sulzer Frères SA). British

Patent 788,288. Dec. 23, 1957. Nuclear Power 3, 200(1958) Apr.

Reactors are commonly thought of as either heterogeneous or homogeneous but this is an idea for combining the two, advantages claimed being: better burnup than a pure heterogeneous type, easy control by altering the concentration of the fissionable solution. According to the one embodiment the heterogeneous core—subcritical on its own—is in the form of slightly enriched uranium rods immersed in a moderator of enriched light water. Between the rods are vessels containing the enriched fissionable solution which is circulated through the core. The moderator is also used as coolant, being kept at sufficient pressure to prevent boiling and also to ensure that possible leaks in the liquid fuel vessels do not contaminate the primary circuit.

11201

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. W. M. Brown and K. J. Mitchell (to General Electric Co., Ltd.). British Patent 789,022. Jan. 15, 1958. Nuclear Power 3, 298(1958) June.

This patent covers the use of an auxiliary pressurized charging machine which is connected as required to a charge tube. The pressurized fuelling machine runs radially on rails which in turn rotate on a turntable about the vertical centerline of the reactor. Thus it can be moved to connect with any given charge tube. (W.D.M.)

11202

METHOD OF AND APPARATUS FOR DETECTING GASEOUS FISSION PRODUCTS IN EFFLUENT LIQUID. (to Atomic Energy of Canada, Ltd.). British Patent 793,905. Apr. 23, 1958. Nuclear Power 3, 298(1958) June.

One of the disadvantages of detecting can failure by monitoring the coolant is that radioactive materials other than fission products are present in the coolant due to neutron irradiation. This patent, which applies to a liquid-cooled reactor, suggests a method of stripping the gaseous fission products from the coolant and transferring them by a non-radioactive carrier gas, such as helium, to a detecting chamber. The stripper may be of two kinds: either one which provides an interface between the coolant and the carrier gas, allowing the fission products to diffuse into it, or one in which the fission products are removed from the coolant and then mixed with the carrier. The type described is a spray tower in which a falling film of liquid presents a large surface area to the carrier gas.

11203

GENERATION OF ELECTRICAL POWER. (to United Kingdom Atomic Energy Authority (USA)). British Patent 791,941. Mar. 12, 1958. Nuclear Power 3, 298(1958) June.

The beta rays emitted during fission are used to generate electricity. Wires or thin cylindrical rods of fuel are surrounded by cylindrical beta collectors of a suitable conductor with a low neutron-absorption cross-section. Insulation is obtained either by evacuating the space between the wire and cylinder or filling it with insulating material. The cylinders and wires are electrically interconnected to two line terminals, and beta particles collecting on the cylinder walls set up a potential difference with respect to the fuel. High-voltage, low-current power is derived from the line terminals, suitable for direct application to mass spectrographs or for uses where a Van de Graaff is usually employed.

11204

METHOD AND APPARATUS FOR GENERATING AND SUPERHEATING STEAM FROM NUCLEAR ENERGY. (to Babcock and Wilcox (USA)). British Patent 793,919. Apr. 23, 1958. Nuclear Power 3, 298(1958) June.

This is a solution-type breeder reactor in which blanket heat is used to superheat steam produced by normal heat exchange from the core. The blanket through which steam is passed consists of a series of concentric cylindrical plates, rotatable about the vertical axis to ensure equal exposure of all their surface to the neutron flux. The blanket fuel may be U-238 or thorium and may include small percentages of fissionable materials. A steam pressurizer is connected into the extension of the pressure vessel at the top. This extension and a similar one on the core enable the pressure to be equalized in the core and blanket chambers so that the core chamber baffle can be of minimum thickness. A modification of the design is also described in which the fuel consists of discrete elements instead of solution.

NUMERICAL INDEX OF REPORTS

This is a list of reports abstracted in this issue of *Nuclear Science Abstracts*, with the corresponding abstract number reference.

The report number codes listed below apply to AEC reports unless otherwise designated. Other codes are listed as British, Canadian, or Non-AEC. Those codes marked Misc. are used for both AEC and non-AEC reports. For a complete description of all report number codes used by the AEC, see TID-85, *Report Number Series Used by the Technical Information Service in Cataloging Reports*. September 1957. 112p. $3.00 (OTS). Some reports appear under more than one code designation and wherever practical all report numbers are listed in this index.

Report No.	Abstract No.
Numerical (Misc.)	
57-GL-206	12-11145
58-RL-1947	12-10675
ACRH	
100	12-10338
AD (Misc.)	
137082	12-10676
151116	12-10582
152228	12-10677
157174	12-10685
158213	12-11115
158214	12-11170
158215	12-11171
158251	12-10868
AEC-tr	
1481	12-10370
3192	12-10427
3216	12-10478
3223	12-10300
3225	12-10795
3230	12-10530
3233	12-10760
3237	12-10369
3251(Pt. 1)	12-10370
3251(Pt. 2)	12-10371
3252	12-10709
3261	12-10632
3262	12-10633
3269	12-10634
3270	12-10406
3271	12-10407
AECL (Canadian)	
543	12-10498
561	12-10289
572	12-11186
585	12-10679
587	12-10908
AECU	
3514	12-11043
3559	12-10966
3657	12-10967
3690	12-10905
3692	12-10601
3693	12-10602
3695	12-10603
3697	12-10968
3698	12-10532
3699	12-10533
3700	12-10534
3706	12-10721
3707	12-11052
3709	12-11053
3710	12-11054
3711	12-11055
3712	12-11056
3713	12-11057
3714	12-11058
3715	12-11059
3716	12-11060
AECU	
3717	12-11061
3718	12-11062
3719	12-11063
3720	12-11064
3721	12-11065
3722	12-11066
3723	12-11067
3724	12-11068
3725	12-11069
3726	12-11070
3727	12-11071
3728	12-11072
3728(Suppl.)	12-11072
3730	12-11073
3731	12-11074
3732	12-11075
3733	12-11076
3733(Add. 1)	12-11076
3735	12-11077
3736	12-11078
3737	12-11079
3738	12-11080
3739	12-11081
3740	12-11082
3741	12-11083
3742	12-11084
3743	12-11085
3744	12-11086
3745	12-11087
3746	12-11088
3747	12-10969
3749	12-11089
AED-BRD (Non-AEC)	
1	12-10744
2	12-10800
3	12-10745
4	12-10801
5	12-10746
6	12-10747
7	12-10748
8	12-10749
35	12-10750
36	12-10751
37	12-10752
38	12-10802
AERE-C (British)	
R-2454	12-10469
AERE-ED (British)	
R-1672	12-10528
AERE-GP (British)	
R-2479	12-10423
AERE-M (British)	
TN-36	12-10970
AERE-Med (British)	
R-2512	12-10293
AERE-N (British)	
R-130	12-10971
R-162	12-10972
AERE-R (British)	
M-167	12-10936
R-671	12-10973
R-2387	12-10973
AERE-T (British)	
M-159	12-10974
R-1617	12-11162
R-2487	12-10975
R-2507	12-11162
AF-SAM (Non-AEC)	
58-58	12-10294
AFOSR-TN (Non-AEC)	
58-195	12-10677
58-410	12-11115
58-411	12-11170
58-412	12-11171
58-446	12-10868
AFSWP (Non-AEC)	
768	12-10678
AGN (Non-AEC)	
8	12-10976
AMRL (Non-AEC)	
332	12-10320
337	12-10295
ANL	
5846	12-10893
APAE	
11	12-10977
21	12-10978
ASTRA (Misc.)	
417-E-1.1	12-10968
BAW	
7	12-11003
BLG (Non-AEC)	
19	12-10803
BMI (Misc.)	
1264	12-10604
1265	12-10979
BNL	
3195	12-10432
3288	12-10376
3392	12-10316
3393	12-10315
3414	12-10461
3437	12-10375
3584	12-11150
3600	12-10980
BR (British)	
763	12-10605
BRL-TN	
843	12-10678
CEA (Non-AEC)	
1(M-H)	12-11053
2(M-H)	12-11054
4(M-H)	12-11055
11(M-H)	12-11056
13(M-H)	12-11057
14(M-H)	12-11058
15(M-H)	12-11059
CEA (Non-AEC)	
16(M-H)	12-11060
17(M-H)	12-11061
18(M-H)	12-11062
19(M-H)	12-11063
20(M-H)	12-11064
21(M-H)	12-11065
22(M-H)	12-11066
23(M-H)	12-11067
24(M-H)	12-11068
25(M-H)	12-11078
26(M-H)	12-11069
27(M-H)	12-11070
28(M-H)	12-11071
29(M-H)	12-11072
29-A(M-H)	12-11072
30(M-H)	12-11073
31(M-H)	12-11074
32(M-H)	12-11075
33(M-H)	12-11076
33-A(M-H)	12-11076
34(M-H)	12-11077
37(M-H)	12-11079
38(M-H)	12-11080
40(M-H)	12-11081
41(M-H)	12-11082
42(M-H)	12-11083
43(M-H)	12-11084
44(M-H)	12-11085
45(M-H)	12-11086
46(M-H)	12-11087
47(M-H)	12-11088
CERN (Non-AEC)	
58-7	12-11172
CF (Oak Ridge National Lab.)	
58-2-135	12-10470
58-3-109	12-10522
58-4-45	12-10523
58-4-56	12-10535
58-4-126	12-10981
58-5-2	12-10753
58-5-32	12-10438
58-5-59	12-10488
58-5-63	12-10505
58-5-79	12-10982
58-5-80	12-10555
58-5-81	12-10556
58-5-97	12-10983
58-5-100	12-10984
58-5-101	12-10985
58-6-6	12-10355
58-6-9	12-10606
CR-Met (Canadian)	
752	12-11186
CRFD (Canadian)	
762	12-10679
CRP (Canadian)	
755	12-10804

Report No.	Abstract No.
CU (Misc.)	
173	12-11044
CWR	
400-6	12-10937
DRCL (Canadian)	
262	12-10286
EES (Non-AEC)	
040069C	12-10551
GAT-DM	
685	12-10536
GEH	
23103	12-10509
HW	
28530	12-10386
43986	12-10576
48340	12-11197
51028	12-10572
51754	12-10345
51825	12-10566
53504B	12-10680
53504C	12-10791
54591	12-10906
54819	12-10472
55178	12-10529
55722	12-10577
55892	12-10784
55905	12-10986
55974	12-10471
IDO	
2021(Rev. 1)	12-10987
2022(Rev. 1)	12-10988
2023(Rev. 1)	12-10989
2024(Rev. 1)	12-10990
14435	12-10387
16052	12-10991
16420	12-10992
16428	12-10993
16459	12-10994
IGO-AM (British	
CA-110	12-10388
W-169	12-10389
IGR-TN (British)	
CA-851	12-10785
IGRL-T (British)	
C-82	12-10607
D-60	12-10448
INS-TCA (Non-AEC)	
11	12-10805
ISC	
318(Del.)	12-10995
910	12-10567
915	12-10496
916	12-10699
921	12-10356
998	12-10473
K	
1257	12-10754
1365	12-10390
1369	12-10391
KAPL	
1637	12-10894
1774	12-10608
1832	12-10321
1844	12-10537
1887	12-10322
1914	12-10323
1918	12-10568
KAPL-M	
DIG-TD-1	12-10996
DOM-3	12-10997
ELW-7	12-10792
FWW-3(Rev. 1)	12-10609
GEG-11	12-10578
GLC-2	12-10755
HS-9	12-10998
KM-1	12-10610
PF-5	12-10999
RLM-15	12-10611
KAPL-M	
SMS-91	12-11000
VFC-2	12-10392
LA	
2171	12-10393
2174	12-10339
LAMS	
2108	12-10569
2199	12-11173
2211	12-10433
M (Misc.)	
3-D537(Del. 2)	12-10474
2846(Del. 2)	12-10474
6196	12-10325
6232	12-10603
6298	12-10366
6499	12-11052
MET (Non-AEC)	
497-582	12-10617
ML	
439	12-11090
513	12-11089
518	12-11091
MLM-CF (Non-AEC)	
58-4-49	12-10681
MND-E (Non-AEC)	
1322	12-10579
MR-N (Non-AEC)	
197	12-10895
209	12-10439
MURA	
406	12-11092
NAA-SR	
2040	12-10806
2150	12-11001
2293	12-10434
2458	12-10570
NACA-TN (Non-AEC)	
4186	12-10538
4311	12-10539
NARF (Non-AEC)	
58-15T	12-10895
58-19T	12-10439
NAVDOCKS-P (Non-AEC)	
290	12-10287
NBS (Misc.)	
5039	12-10357
NDA	
086-2	12-10938
64-101	12-11002
NLCO	
727	12-10612
728	12-10358
729	12-10359
730	12-10360
NMI	
1204	12-10613
NNES	
III-3	12-10476
NP (AEC File No. for Non-AEC Reports)	
6709	12-10682
6710	12-10896
6712	12-10614
6713	12-10683
6714	12-10361
6716	12-10722
6717	12-11174
6719	12-10907
6722	12-10506
6726	12-11116
6728	12-10540
6729	12-10580
6730	12-10394
6731	12-10756
6733	12-10615
6735	12-10362
6747	12-10335
NP (AEC File No. for Non-AEC Reports)	
6759	12-10616
6760	12-10363
6761	12-10364
6762	12-10939
6763	12-10296
6764	12-10297
6766	12-11146
6767	12-10435
6768	12-10940
6769	12-10292
6770	12-10617
NP-tr (AEC File No. for Non-AEC Translations)	
83	12-10869
84	12-11175
85	12-11176
86	12-10870
87	12-10871
88	12-10872
89	12-11119
91	12-10691
92	12-10909
93	12-10910
94	12-10873
95	12-10874
96	12-11120
97	12-11177
98	12-11121
100	12-10489
101	12-10490
NPG	
171	12-11003
NRL (Non-AEC)	
5083	12-10807
5121	12-10365
5133	12-10618
5138	12-10552
NRL-M (Non-AEC)	
3434	12-10619
NYO	
2052	12-11047
2172	12-11117
6633	12-10941
7771	12-10782
8526	12-10620
ORNL	
1801(Del.)	12-10475
2152	12-10581
2501	12-10684
2509	12-11004
2520	12-10621
2530	12-10499
PLAC (British)	
8	12-11093
PR-P (Canadian)	
37	12-10908
RDB(C)/TN (British)	
24	12-10622
RDB(CAP)/TN (British)	
96(Del.)	12-10507
RDB(W) (British)	
TM-1226	12-11147
REIC (Non-AEC)	
5	12-11148
7	12-10685
RFP	
92	12-10324
100	12-10508
RIB	
34	12-10686
RM (Misc.)	
204(RAND)	12-10793
SCDC	
653	12-10757
SCL-T	
187	12-10692
188	12-10385
SCR	
15	12-10553
17	12-10687
18	12-10688
SCTM	
80-57(51)	12-10325
129-58(51)	12-10689
163-58(16)	12-10623
201-54-51	12-10794
346-57(14)	12-10758
347-57(14)	12-10759
SWP/P (British)	
21	12-11162
TEI	
581	12-10600
615	12-10518
700	12-10595
TID	
3512	12-10346
4550(5th Rev.)	12-10282
5224	12-10476
5522	12-10509
7015(Sect. 1)	12-10395
7015(Secs. 3 and 5)	12-10396
8018	12-10624
8019	12-10625
TML (Non-AEC)	
92	12-10626
100	12-10627
104	12-10628
UCRL	
1648	12-10897
3808	12-10950
3887	12-10942
4892	12-10768
4974	12-10443
5006	12-11005
5065	12-10366
5167	12-10808
5225	12-10727
5227	12-10367
5229	12-11118
5230	12-10943
8115	12-10326
8225	12-10421
8255	12-10728
UK/C (Canadian)	
6/124	12-10944
UR	
521	12-10298
522	12-10342
USNRDL-TR (Non-AEC)	
228	12-10477
230	12-10809
235	12-10690
239	12-10299
243	12-10327
UWFL	
51	12-10397
WADC-TR (Non-AEC)	
57-302	12-10582
57-627	12-10723
WAL-TR (Non-AEC)	
541/1	12-10368
WAPD-CDA	
(AD)-383	12-10524
(I)-86	12-10583
WAPD-CTA	
(GLA)-203	12-10398
(GLA)-471	12-10399
(GLA)-500	12-10400
(GLA)-501	12-10401
(GLA)-506	12-10402
(GLA)-511	12-10403
(GLA)-542	12-10404
WAPD-PWR	
CP-2649	12-11000

Report No.	Abstract No.	Report No.	Abstract No.	Report No.	Abstract No.	Report No.	Abstract No.
WAPD-PWR		WAPD-T		WAPD-TM (Misc.)		WIN	
CP-3092	12-10405	416	12-10585	113	12-10554	88	12-10512
PMA-1517	12-11007	550	12-10630	114	12-11011	96	12-10513
PMM-491	12-10510	588	12-10541	WAPD-ZH		WKNL	
PMM-674	12-11008	WAPD-TH		7	12-10631	106	12-11012
PMM-1240	12-10584	307(Del.)	12-10542	WCLT-TM (Non-AEC)		YAEC	
PMM-1840	12-10629	426(Del.)	12-11010	58-66	12-10810	33	12-11013
WAPD-SSW-EP		WAPD-TM (Misc.)		WIN		64	12-11014
45	12-11009	8	12-10543	76	12-10511		

PERSONAL AUTHOR INDEX

This is an index for the reports abstracted in this issue. For each reference the number preceding the dash is the volume number and the number after the dash is the abstract number. Personal author indexes are cumulated on a semiannual and annual basis.

A

ABRATT J D
12-10319
ABRAMS C S
12-11006
ACHTER M R
12-10552 12-10618
ADAMS R E
12-10355 12-10488
ADO IU M
12-11109
AFANASEV N G
12-10814
AGLINTSEV K K
12-10819 12-10867
AKHIEZER A I
12-10739 12-11139
AKIMOV YU K
12-10845
AKULKINA L M
12-10384
AKUTSU JUICHI
12-10825
ALBAUGH F W
12-10986
ALEKSANDROV YU A
12-10932
ALEKSEEVA K I
12-10713
ALFORD W P
12-11117
ALLEN B C
12-11148
ALLEN BETTY
12-10896
ALMASSY GYULA
12-10521
ALMAZOV A V
12-10702
ALTSCHULER ZALMAN S
12-10518
AMBROZHIY. M N
12-10467
AMPHLETT C B
12-10483 12-10491
12-10492
ANDERSON FRANKLIN R
12-10573
ANDERSON P J
12-10970
ANDERSON SAMUEL
12-10356
ANDREWS M C
12-10677
ANDREYEVA Z F
12-10466
ANGIER D J
12-10456
ANICETTI R J
12-10566
ANIKINA M P
12-11193
ANNO JAMES N
12-10979
ANSELM A A
12-11137
APPLEBY CHARLES W
12-10808
ARDASHNIKOV S N
12-11153
ARMSTRONG W A
12-10458
ARNOLD E D
12-10525
ARONOVICH P M
12-10821
ARTEMENKOV L I
12-10807
ARTSIMOVICH L A
12-10780
ASATIANI T L
12-10717
ASEYEV G G
12-10783 12-10790
ATHERTON D R
12-10344
AZAROFF LEONID V
12-10723
AZOVSKIY YU S
12-10783 12-10790

B

BACKER R O
12-10399
BAEDER D L
12-10452
BAILEY G M
12-10815
BAIRD W A
12-10439
BAKANOV S P
12-10549
BAKER J F
12-10581
BAKER J M
12-11160
BAKH N A
12-10459
BALDWIN W M JR
12-10721
BALKANSKI M
12-10361
BALLOU N E
12-10477
BALSHIN M YU
12-10654
BANKS CHARLES V
12-10356
BANNIK B P
12-10879
BARADZEI L T
12-10714
BARANOV A I
12-10644
BARANOV S A
12-10945
BARASHENKOV V S
12-10869 12-10871
BARGHUSEN JOHN
12-10473
BARILENKO A V
12-10559
BARINOVA YE S
12-10848
BARKER F B
12-10527
BARROW R F
12-10382
BARTLETT ALBERT A
12-10328
BARTOCHA BODO
12-10377
BARTON C J
12-10499
BARTON W W
12-10487
BARTSCH A F
12-10526
BARTSCHAT F
12-10607
BASHAM SAMUEL J
12-10593
BATENIN I V
12-11188
BATES J C
12-11147
BATTIG A
12-10882
BAUER ARTHUR A
12-10604
BAUGHMAN DOROTHY
12-10367
BEAN K E
12-10722
BECRAFT GEORGE E
12-10600
BEDO D E
12-11099
BEDREAG C G
12-10419
BEETS C
12-10803
BEGLARYAN A G
12-10300
BEICHLER GLENN P
12-10678
BELASHCHENKO D K
12-10632
BELIAK A IA
12-11110
BELL I P
12-10622
BELL J S
12-11133
BELL JOHN H JR
12-10433
BELL W H
12-10542
BELLE J
12-10510
BELLWARE M D
12-10661
BELSKIY YE I
12-10664
BELYAEV YU I
12-10611
BELYANIN V B
12-11158
BENNETT L L
12-10753
BENTLEY P G
12-10785
BERGDORF WILLIAM H
12-10582
BERISFORD R
12-10424
BERKHOVSKIKH S M
12-11152
BERKOVICH I B
12-10716 12-10841
BERKOWITZ JOSEPH
12-10380
BERLIN T H
12-11047
BERNSTEIN JEREMY
12-11074
BETTMAN JEROME W
12-10340
BHATIA ANAND K
12-10868
BHATIA B B
12-10394
BIDZILYA N I
12-10306
BIEDENHARN L C
12-10893
BIERLEIN T K
12-10572
BIERSCHENK W H
12-10565
BIGHAM C B
12-10944
BILENKII S M
12-10930 12-11141
BILLEN DANIEL
12-10330
BLACKBURN P E
12-10506
BLANK V Z
12-11121
BLANKE BERTRAM C
12-10681
BLANKENBECLER R
12-11115
BLANTER M YE
12-10655
BLEANEY B
12-11160
BLEIBERG M L
12-10543 12-11196
BLOKH YA L
12-10712
BLOKHINTSEV D I
12-10869
BLOKHINTSEV L D
12-10881
BLOMEKE J O
12-10525
BOADLE C D
12-11024
BOBYKIN B V
12-10960
BOCHAGOV B A
12-10860
BOGACHEV N P
12-10870 12-10911
BOGDANOV G F
12-11046
BOGOIAVLENSKII I V
12-10779
BOGOLYUBOV NIKOLAY N
12-10691 12-10912
12-10930 12-11185
BOLAND LAWRENCE F
12-10649
BOLING E A
12-10809
BOND VICTOR P
12-10313 12-10327
BONDELID R O
12-10807
BOOMAN GLENN L
12-10387
BOOTH A
12-10827
BOROVIK-ROMANOV A A
12-10760
BORZENKOVA M P
12-10427
BOXER G
12-10548
BOYD W K
12-10580
BOYLAND D A
12-11199
BRADLEY EDWARD L
12-10635
BRADSHAW P LOUIS
12-10334
BRADSTREET S W
12-10435
BRAGINSKII S I
12-10736 12-10737
BREDIG M A
12-10379
BREGINA A YU
12-10890
BRENDEN B B
12-10529
BRENNAN JOHN E
12-11030
BRENNAN MARY F
12-10482
BRENY H
12-10803
BRESLER B
12-10614
BREUSOV O N
12-10428
BREY R H JR
12-11033
BRIEF RICHARD S
12-10479
BRIGOLI B
12-10426
BRIKKER S I
12-10713
BROBECK W M
12-10768
BROCKLEHURST R E
12-10810
BROHULT ASTRID
12-10332
BROOKS J J
12-10487
BROOKS L H
12-10520
BROTHERS J A
12-10504
BROWN F H
12-10403
BROWN G E
12-11128
BROWN M A
12-10606

BROWN R E
12-10565
BROWN W LYNN
12-10294
BROWN W M
12-11201
BROWNING W E
12-10355 12-10488
BRUCER MARSHALL
12-10350
BRUCH C A
12-10462
BRUNDIGE E L
12-10624 12-10625
BRUNST V V
12-10301
BRUNSTETTER D G
12-11014
BRUSSAARD P J
12-10953 12-10954
BRUSTAD TOR
12-10811
BUGORKOV S S
12-10836
BULL W C
12-10588
BUNNEY L R
12-10477
BUPP L P
12-10986
BURCH W D
12-10445
BURGER L L
12-10484
BURGOV N A
12-11138
BURLAKOV V D
12-10561
BURSIAN E V
12-10575
BUSH E A
12-10571
BUSING W R
12-11165
BUTLER C P
12-10690
BYKOV V N
12-11166

C

CALABRA A E
12-10508
CALDERWOOD F WAYNE
12-10567
CAMPO ROBERT D
12-10313
CARLSON A R
12-10866
CARNALL W T
12-10502
CARRUTHERS J A
12-10286
CASARETT GEORGE W
12-10298
CASON MAGGIE
12-10366
CASTELLANI E
12-10309
CHAIKA M P
12-10411
CHAMBERLAIN A C
12-10293
CHANDRASEKHAR S
12-10798
CHANG ROGER
12-10570
CHAO CHOU KUANG
12-11176
CHAPMAN T S
12-10324
CHASTAIN JOEL W JR
12-10979
CHASTNIKOV I YA
12-10839
CHAUDHRI RAFI M
12-10829
CHAYKOVSKIY V G
12-10855
CHERENKOV P A
12-11109 12-11110
CHERNYAYEV V B
12-10858
CHERNYKH V I
12-10427
CHERURIN L J
12-10922
CHETVERIKOV N S
12-11153
CHIKOVANI G YE
12-10852
CHIRIKOV B V
12-10846
CHKUASELI D V
12-10786
CHUDAKOV A YE
12-10853
CHUPKA WILLIAM A
12-10380
CHURCH JAMES S
12-10433
CHUVELEVA N P
12-10636
CHUVILE I V
12-11119
CLARK C A
12-10638
CLARK C R
12-10794
CLARK DWIGHT E
12-10338
CLARKE ERIC T
12-10558
CLAY R E
12-11093
CLEGG A G
12-10694
CLEMENSEN R E
12-10768
COCKRELL J L
12-11042
CODD J
12-10973
COF D G
12-10457
COHEN ANNA FONER
12-10430
COHEN H
12-10676
COHEN I
12-10672
COLBECK E W
12-10647
COLE F T
12-11092
COLEMAN E J
12-10345
COLLINS F R
12-10663
COLP JOHN L
12-10553
CONGDON CHARLES C
12-10330
CONRAD BERND
12-11154
CONSALVO V F
12-10392
CONWAY J B
12-10648
COOK T B JR
12-10818
COOPER JAMES ARLIN
12-10757
CORBETT JOHN D
12-10496
CORNET I
12-10614
COTTRELL A H
12-11151
CRANDALL W
12-10897
CRAWFORD BRYCE JR
12-10431
CRONKITE EUGENE P
12-10313
CROUCH E G H
12-10974
CULLER F L JR
12-10486
CUNINGHAME J G
12-10951
CUNNINGHAM A L
12-11035
CUNNINGHAM J R
12-10286
CUTLER G L
12-10611 12-10755

D

DAMASKIN B B
12-10490
DANEK G J JR
12-10552
DANIELS ROBERT F
12-10758 12-10759
DAR REHANA
12-10829
DAVEY H G
12-11022
DAVIDSON L
12-11002
DAVIS HAROLD S
12-11041
DAVIS W C
12-10700
DAVYDOV A S
12-10964
DE HALAS D R
12-11039
DE HEVESY GEORGE C
12-10319
DE WAARD HENDRIK
12-11156
DEARING BURTON E
12-10482
DEARING FRED E JR
12-10577
DEBOISBLANC D R
12-10994
DEBRICK KENT G
12-11090
DEFLEY C W
12-10460
DEFELICE J
12-11002
DEKLEVA JANEZ
12-11067 12-11069
12-11084
DELONE N B
12-10932
DEMIDOV A M
12-11045
DEMYANOV YU A
12-10704
DENISOV A I
12-10385
DENKO J D
12-10333
DERYAGIN B V
12-10549
DESIDERIVA I P
12-10369
DEWEES N R
12-10630
DICKERSON RONALD E
12-10604
DIDDENS ALBERT NOMDO
12-11169
DIXON FRANK J
12-10312
DNESTROVSKII YU N
12-11182
DOBROLYUBSKAYA T S
12-10373
DOCKUM N L
12-10345
DODGE RICHARD PATRICK
12-10421
DODSON R W
12-10376
DOLGOPOLOV D G
12-10779
DOLINSKII E I
12-10881
DOLL D T
12-10569 12-10624
12-10625
DOLLEZHAL N A
12-11015
DONAHOE JOHN K
12-10433
DONALDSON YE YE
12-10816
DONDES S
12-10454
DORN JOHN E
12-10615
DORSCHU K E
12-10658
DOVZHENKO O
12-10711
DOWDEN ROBERT M
12-10296
DOYLE W L
12-10648
DRELL S D
12-11170 12-11171
DRINKER PHILIP A
12-10479
DUNN D W
12-10538
DUNNING FRED S
12-10522
DURAN J B
12-10623
DUTT I
12-10949
DUTTA AJIT KUMAR
12-10437
DZHELEPOV B S
12-11155
DZHELEPOV V P
12-10693

E

EASTES J W
12-10588
EBINA TOSHIAKI
12-10307
EFROS I A
12-10586
EHRENREICH R
12-10554 12-10583
EICHENBERG J D
12-10672
ELLIOTT J R
12-10348 12-10349
ELLIOTT REED O
12-10381
ELLIS J F
12-10519 12-10520
ELLISON C V
12-11004
ELSEA A R
12-11148
EMELIANOV A A
12-11050
ENTENMAN C
12-10299
EPEL L G
12-10983
ERICSON G L
12-10580
ERMAKOVA K I
12-10716
EROZOLIMSKY B G
12-10922
ERSHLER B V
12-11193
ESPER RICHARD T
12-10541
EVANS E B
12-10721
EVERSON I
12-11025
EYG L S
12-10855 12-10856

F

FAILLA G
12-10743
FAIRBANKS F R
12-10977
FAIZULLIN F F
12-10369
FALK MICHAEL
12-10447
FARQUHARSON J
12-10754
FAULKNER G E
12-10628
FAUSSONE ROSCOE A
12-10433
FAYRAM P A
12-10976
FEDOROV A A
12-11123
FEDOROVA A G
12-10467
FELDBAUM A A
12-10797
FELL E A
12-10638
FERREBEE JOSEPH W
12-10330
FERRISS DONALD P
12-10620
FETISOV N I
12-11187
FIELDS P R
12-10502
FILIPPOV G F
12-10961 12-10964
FINKEL ASHER J
12-10343
FISCHER J
12-11175
FITSNER L N
12-10797
FITZGERALD J J
12-10322
FLANARY J R
12-10470 12-10475
FLECK ALEXANDER
12-10335
FLEROV G N
12-11049
FLESHER ANNA M
12-10331
FLINT DUANE L
12-10540
FLOE C F
12-10621
FLOYD R L
12-10344
FOMUSHKIN E F
12-11192
FORSSBERG A G
12-10319
FORSYTH R S
12-10448
FOTCHENKOV A A
12-10770
FOTI S
12-10477
FOURNAUX J
12-10803
FRADKIN E E
12-10931
FRANCIS G E
12-10347
FRANK G M
12-10283
FRANK I M
12-10921
FRANK P W
12-10554
FRANKFORT J H
12-11012
FRANKLIN E
12-10771
FRANKS A
12-11132
FRASER J C
12-11145
FRASER J P
12-10999
FRASER M C
12-10576
FRASHIER L D
12-10475
FRAUTSCHI S C
12-11171
FREEMAN J H
12-10423
FRENCH J B
12-11174
FRIEDBERG A L
12-10592
FRIEDMAN HAROLD L
12-10453
FRIEDMAN L
12-10432
FRISH S E
12-11195
FRITSCH A R
12-10950
FROST FREDERICK E
12-10727
FROST P D
12-10626 12-11148
FRUMKIN A N
12-10489 12-10490
FUJII KANJI
12-10916
FUKUI SHUJI
12-10805
FULLER G H
12-10965
FURGERSON W T
12-10983
FURUKAWA JUNJI
12-10697

G

GAGARINSKII YU V
12-10948
GAHR R A
12-10608
GALAKTIONOV A I
12-10853 12-10854
GALANIN A D
12-11027 12-11028
GALANIN M D
12-10821
GALONIAN G E
12-10578
GAMBILL W R
12-10535
GANDUSIO G
12-11019
GANZ AARON
12-10350
GARDNER DONALD GLENN
12-11043
GARDNER H R
12-11197
GARELLI C M
12-10875
GASPER G W
12-10321

PERSONAL AUTHOR INDEX

GAST P F
12-10986
GAUTHIER R
12-10686
GAVRILOVSKII B V
12-10963
GAYEVSKAYA L A
12-10653
GEIGER E L
12-10866
GEILIKMAN B T
12-10917
GELMAN A D
12-10500
GERASIMOVA N M
12-10718
GERASIMOVSKIY V I
12-10597
GERSHMAN R B
12-10666
GIBBONS EDWARD J
12-10545
GIESE CLAYTON F
12-10380
GIGUERE PAUL A
12-10447
GILBERT C W
12-10834
GILBERT W S
12-11005
GILL E KERRY
12-10495
GILMAN J J
12-10429
GINZTON EDWARD L
12-11091
GLAMM ARTHUR C
12-10482
GLAZKOV N P
12-10844
GLAZOV V M
12-10640
GLUSHKOVA A S
12-10820
GOLBEK G R
12-10812
GOLDIN L L
12-10850
GOLDMAN K M
12-10585
GOLDSMITH E A
12-10594
GOLDSTEIN H
12-10938
GOLOVKIN V S
12-11166
GOLUBEV YU M
12-10807
GONCHAR V IU
12-10814
GONCHAROV V V
12-10436
GOODE J H
12-10470
GORRACHEV V M
12-10837
GORDEYEV L V
12-10898
GORHAM EVILLE
12-10828
GORMAN JOHN W
12-10546
GORSHKOV G V
12-10904
GORSHKOV V K
12-11193
GORYUSHINA V G
12-10418
GOVE H E
12-10804
GOWARD G W
12-10398 12-10399
12-10400
GRADY LEONARD P
12-10678
GRAGEROV I P
12-10415
GRAHAM W A G
12-10377
GRANT G A
12-10458
GRANT N J
12-10621
GRASSI R C
12-10614
GRAY J L
12-10289
GREENBLATT M H
12-10764
GREENE CHARLES H
12-10463
GREENE N D
12-10535
GREGG J L
12-10539
GRESKY A T
12-10525
GRIFFEL MAURICE
12-10699
GRIGOREV V N
12-10779
GRIGOROV N L
12-10713
GRIMES W R
12-10499
GRISHIN V G
12-10869 12-11119
GRISHUK G I
12-10850
GROBECKER D W
12-10623
GROSHEV L V
12-11045
GROSS W
12-10743
GROSSE A V
12-10648
GROTH W
12-10448
GROVER J R
12-10564
GRYAZEV V M
12-10947
GUERZONI C
12-10309
GUSEV M I
12-10788
GUSEV V M
12-10786
GUSEVA M I
12-10786
GUTKIN T I
12-10778
GUTNIKOVA YE K
12-10900
GUZHAVIN V V
12-10715

H

HAACK L A
12-10985
HAAS P A
12-11004
HAGEDOORN H L
12-10956
HAGEDORN R
12-11172
HALE WILLIAM M
12-10315 12-10316
HALEY THOMAS J
12-10331
HALL A M
12-10639
HALL J A
12-10444
HAM F S
12-10675
HAMER A N
12-10785
HAMMOND E J
12-10513
HANKS G S
12-10624 12-10625
HANNA G C
12-10944
HANRATTY THOMAS J
12-10540
HANSEN MAX
12-10669
HANSEN WILFORD N
12-10699
HANSON G L
12-10471
HANSON J E
12-10577
HARDIN K D
12-10687
HARRICK N J
12-10698
HARRIS R L
12-10588
HARRIS D R
12-11011
HARRIS JAMES C
12-10905
HARRIS JEAN
12-10661
HARRIS L A
12-10505
HARRIS P S
12-10339
HART R G
12-10504
HARTECK P
12-10454
HARTING D
12-11129
HARTLEY M G
12-10766
HARTNETT J P
12-10550
HASSITT A
12-10975
HAUSNER HENRY H
12-10620
HAWKINS J D
12-10347
HAYAKAWA SATIO
12-10710
HECK FRANK W
12-10620
HEMMIG P B
12-10810
HENRI V P
12-11082
HENRIKSEN THORMOD
12-10811
HERRING JACKSON R
12-11125
HICKMOTT R L
12-10810
HIIDA KICHIRO
12-11134
HILL J F
12-10973
HISKES JOHN R
12-10728
HIZA M J
12-10357
HLAVAC JAN
12-11026
HODGES FRED JENNER
12-10337
HOLADAY D A
12-10526
HOLBROOK WAYNE R
12-10387
HOLLAND SAMUEL S JR
12-10902
HOLLAND T E
12-10700
HOLLANDER J M
12-10950
HOLLIDAY A K
12-10378
HOLLIS E T
12-10512
HOLT J R
12-11129 12-11130
HOLT JOHN FLOYD
12-10337
HOOPER R B
12-10626
HOPKINS WALTER E JR
12-10541
HORTON J C
12-10390
HOTTA YUTAKA
12-10478
HRYNKIEWICZ A Z
12-10940
HSIAO C C
12-10657
HSIEH SHIH-HUI
12-10915
HUIJER P
12-10903
HUMMEL F A
12-10571
HUO M
12-10833
HURSH JOHN B
12-10342
HUTCHISON CLYDE A JR
12-10476

I

IARLOKOV B N
12-11110
ILBERY P L T
12-10308
ILINSKIY V N
12-10858
ILYINA L I
12-10303
IMAI HIDEO
12-10516
IMAMURA TSUTOMU
12-11179
INGHRAM MARK G
12-10380
INMEN M C
12-10767
INN E C Y
12-10690
IORDANSKIY S V
12-10703
IRSA A P
12-10432
ISAEV P S
12-11121
ISHIDA KIN-ICHI
12-11178
ISMAILZADE I G
12-10574
IVANENKO I P
12-10715 12-10720
IVANOV P N
12-11193
IVANOVA N I
12-10900
IVANOVA N S
12-10924
IWATA KENZO
12-10916

J

JACOX HAROLD W
12-10337
JAGN YU I
12-10642
JAMES J B
12-10771
JAMIESON C P
12-11009
JARVESOO ELMAR
12-10489 12-10490
JEFFERS W
12-10378
JERVIS M W
12-10772
JOHNSON J W
12-10379
JOHNSON K D B
12-10519 12-10520
JOHNSTON W G
12-10429
JOLLY WILLIAM L
12-10443
JONES E R W
12-10638
JONES L J
12-10510 12-11196
JONES R H
12-10534
JONKER C C
12-10903
JUNG RICHARD G
12-10979

K

KADE HAROLD
12-10351
KALININ S P
12-11046
KALISH H S
12-10671
KALITEEVSKY N I
12-10411
KALITEYEVSKIY N I
12-11163
KALLMAN DONALD
12-11030
KALLMANN HARTMUT
12-10683
KALOS M H
12-10938
KANAYA KOICHI
12-10696
KANNUNIKOV V N
12-11110
KANT ARTHUR
12-10368
KAPLAN G YE
12-10514
KAPLAN HENRY S
12-11091
KARARANOV N I
12-11123
KARADZHEV K V
12-10963
KARAMYAN A S
12-10819
KASS S
12-10585
KATO AKIRA
12-10696
KATZ K
12-10541
KAWASAKI KOJI
12-10442
KAWASAKI SHINKICHI
12-10824
KAY J M
12-11021
KAY R E
12-10299
KAZARINOVA M I
12-10837
KEELER J R
12-10509
KEENAN T K
12-10502
KEENE J P
12-10834
KELLEY G G
12-10763
KEMPTER CHARLES P
12-10381
KENNEDY C A
12-10807
KENNEDY M R
12-10321
KERETAKES J G
12-10795
KERIMOV B K
12-11142
KETZLACH NORMAN
12-11037
KGOL F
12-10769
KHALFIN L A
12-10929
KHALKIOPOVA N N
12-10851
KHAN MUSTAFA YAR
12-10829
KHATSKEVICH M V
12-10544
KHAWAJA ABIDA
12-10829
KHIRNYY YU M
12-10702
KHLEBNIKOV N S
12-10774
KHOKHLOVA Z S
12-10716 12-10841
KHORMUSHKO S P
12-10822
KHRAMOV V P
12-10468
KHRIMIAN G V
12-10717
KHRISTOV KH YA
12-10719 12-11136
KIKUCHI KEN
12-11048
KIMBER G
12-10827
KING L A
12-10810
KING N M
12-11100
KINSEY EDWARD J JR
12-10582
KIRCHER J F
12-10685
KIRSHIN G F
12-10860
KISELEVA A B
12-10867
KLAIN PAUL
12-10660
KLAPPER J A
12-11002
KLIGERMAN MORTON M
12-10337
KLIMENTOV V B
12-10947
KLINE D E
12-10460
KLINE ROBERT J
12-10503
KLOVERSTROM F A
12-11005
KLUYVER J C
12-11130
KNAPP LESTER
12-10473
KNOP OSVALD
12-10447
KOBAYASHI JINZO
12-10725
KOCHAROV G YE
12-10860
KOGAN P M
12-10838
KOGAN V I
12-10730
KOH YUJIRO
12-11135
KOHL J
12-10865
KOLCHIN O P
12-10636

KOLESNIKOV N N
12-10892
KOLLER P C
12-10308
KOLOMENSKII A A
12-11095 12-11105
12-11108
KOMAR E G
12-11106
KOMESU NATHAN
12-10331
KOMISSAROVA L N
12-10384
KONDRASHEV L F
12-11104
KONIG VOLKER
12-11154
KONIJN J
12-10956
KOOPMAN K H
12-10662
KOPITUK R C
12-10651
KOPYLOVA D K
12-10879
KORABLEV L N
12-10712
KORENCHENKO S M
12-10874
KORNBERG HARRY A
12-10354
KORNBLITH LESTER JR
12-11034
KOROSTYLEVA L A
12-11159
KORSHUNOV N S
12-10544
KOSEVICH A M
12-10706
KOSMAN M S
12-10575
KOSTOMAROV D P
12-11182
KOTOV V I
12-11103 12-11114
KOVAC L R
12-10969
KOYAMA K
12-10784
KRACIK JIRI
12-10729
KRAFT O E
12-11155
KRAINIK N N
12-10707 12-10708
KRASAVINA L D
12-11157
KRAUCH HELMUT
12-10375
KREYMER G S
12-10644
KREYMER P S
12-10673
KROEGER H R
12-10968
KROKHIN YU V
12-10773
KRONBERGER H
12-10562
KRUCOFF D
12-10967
KRUPKIN A I
12-10412
KRYSTYNIAK C W
12-10568
KUDRIASHOV P I
12-10705
KUKAVADZE G M
12-11193
KULBERG L M
12-10467
KUNDU D N
12-10965
KURDYUMOV G V
12-10283
KUROSU MORIJI
12-10307
KUZNETSOV A B
12-11114
KUZNETSOV E V
12-10864
KUZNETSOV L I
12-10655
KUZNETSOVA YE B
12-10867
KVASHNINA YE I
12-10670
KYANDARYAN K A
12-10300

L

LACY WILLIAM J
12-10523
LAIDLER K J
12-10495
LAITINEN H A
12-10394
LAKHANIN V V
12-10290
LANGE E A
12-10365
LANGEVIN M
12-10939
LANZA G
12-11069 12-11075
12-11076 12-11079
12-11081
LAPIDUS L I
12-10910 12-11120
LARKINS J H
12-10339
LARSEN F W
12-10550
LARSON T E
12-10590
LATYSHEV G D
12-11168
LAVIA M F
12-10333
LAVRUKHINA A K
12-11157
LAZAREVA L E
12-10928
LE ROY D J
12-10424
LEARNER A
12-10796
LEBEDEV A N
12-11108
LEDOUX JOHN C
12-10522
LEFORT H G
12-10592
LEHMANN WALTER J
12-10493 12-10494
LEMPGES T E
12-10534
LEPEKHIN F G
12-10716 12-10841
LETOURNEAU B W
12-10542
LEVDIK V A
12-11166
LEVICH V
12-10370 12-10371
LEVINA L YE
12-10789
LEVINGER J S
12-11128
LEVY P W
12-11150
LEYPUNSKIY O I
12-10288
LEYSE C F
12-10991
LICHTENBERG ALLAN J
12-11057 12-11065
12-11066
LIKHTER A I
12-11161
LINDLEY P A
12-11198
LIPIS L V
12-10411
LIVINGSTON M STANLEY
12-11053 12-11054
12-11059 12-11060
12-11063 12-11064
12-11068 12-11070
LLOYD R
12-10524
LOBANOV IU N
12-11111
LOCKETT A M III
12-11171
LOCKETT F
12-10972
LOCKWOOD L F
12-10660
LOGUNOV A A
12-10930
LOHR MAX
12-10692
LOMANOV M F
12-10846
LONG R B
12-10452
LONGO J JR
12-10996
LONGWELL J P
12-10452
LORINA G A
12-10412
LORING BLAKE M
12-10619
LOSCO E F
12-10672
LOUNSBURY M
12-10425 12-10944
LOUTIT J F
12-10308
LOWMAN FRANK G
12-10397
LU WAN CHING
12-10330
LUCCHESI P J
12-10452
LUKIN YU T
12-10839
LUSTIG H
12-10938
LUTSENKO V N
12-11045
LYNESS J N
12-11131
LYONS WILLARD B
12-10943

M

MACGREGOR MALCOLM H
12-10943 12-11118
MACHIDA SHIGERU
12-10877
MACKENZIE L A
12-10834
MACNAUGHTON DANIEL R
12-10997
MACY RUDOLPH
12-10588
MAEDER D
12-10831
MAKOWER R U
12-10302
MALKIN L Z
12-10836
MALLORY KENNETH B
12-10891 12-11091
MALTSEV V M
12-10909
MANDELSHTAM S L
12-10410
MANDEVILLE C E
12-10937
MANDL F
12-11133
MANDZHAVIDZE Z SH
12-10852
MANKO V I
12-10963
MANLY W D
12-10659
MANSFIELD W K
12-10935
MANUKHIN A I
12-10797
MARION JERRY B
12-10896 12-10965
MARSDEN R S
12-10994
MARTIN F S
12-10469
MARTYNOV YU G
12-10848
MARUYAMA TAISUKE
12-10762
MARVIN JAMES F
12-10352
MASON EDWARD A
12-10742
MASON H C
12-10329
MASTEL B
12-10572
MATHERS W G
12-10504
MATINYAN S G
12-10886
MATTA A
12-10309
MATVEYEV V V
12-10812
MATVIENKO V I
12-10904
MAUPIN A A JR
12-10680 12-10791
MAUTZ EARL W
12-10358 12-10359
12-10360 12-10612
MAYER J E
12-10741
MAYNARD G R
12-10367
MCBUGH W E
12-10462
MCCAIG M
12-10694
MCCALLUM K J
12-10450
MCCLINTOCK R M
12-10357
MCCORKLE K H
12-11004
MCCORMICK J A
12-10346
MCCREADY C C
12-10417
MCDONALD J J
12-10622
MCDONALD L A
12-10483 12-10491
12-10492
MCDOWELL A A
12-10294
MCEWEN L H
12-10986
MCFADDEN W H
12-10425
MCGINNIS C L
12-10965
MCGRATH P E
12-10405
MCMURRY H L
12-10992
MCNAMEE R J
12-10438
MCNELLY MALCOLM J
12-11040
MCWHERTER J R
12-10581
MEDCALF W E
12-10722
MEFODEVA M P
12-10500
MEHAN R L
12-10611
MEKHEDOV V N
12-10927
MELAMID A YE
12-10774
MELNIKOV G P
12-10857
MELTSER L V
12-10547
MELVILLE COLIN
12-10311
MEREDITH ORSELL M JR
12-10351
MERZBACHER EUGEN
12-11125
MESCHAN ISADORE
12-10353
MESHCHANINOVA L V
12-10384
MESHCHEROV R A
12-11101
MESHKOVSKII A G
12-10883
MEYERSON G A
12-10514
MIDDLEHAM T H
12-10647
MIHUL A C
12-10870
MIKHAILOV B M
12-10821
MIKHALENKO I P
12-10948
MIKHEYEV N B
12-10408
MILLBURN G
12-10897
MILLER A E
12-10434
MILLER EDWARD M
12-10296
MILLER G L
12-10674
MILLER P D
12-10580
MILLER PHILIP
12-11012
MILLS I M
12-10431
MILLSAP W A
12-10511
MILOVANOV O S
12-11098
MINASSIAN K
12-10610
MINKEVICH A N
12-10656
MIRAGLIA M S
12-10295
MIRKIN I L
12-10634
MIRONOV YE S
12-11101
MITCHELL K J
12-11201
MIYAMOTO SIGENARI
12-10805
MIYATAKE OSAMU
12-11135
MIYAZAKI YUKIO
12-10824
MIZUTANI TSUTOMU
12-10478
MOHR C B O
12-11127
MOISEYEV B N
12-10843 12-10849
MOLE R H
12-10318
MONAHAN J E
12-10893
MONIN A S
12-10889
MONOSZON N A
12-11106
MOORE J A
12-11129 12-11130
MOOS W S
12-10329
MOREY R E
12-10365
MORGAN E L
12-10894
MORGAN ERIC R
12-10652
MORGAN H W
12-11165
MOROZ E M
12-11107 12-11113
MOROZOV IU M
12-10948
MORRIS W
12-10372
MORSE R H
12-11033
MORTON G A
12-10817
MOSKALEV V A
12-11096
MOTE M W
12-10626
MOTT B W
12-10605
MOZALEVSKII I A
12-11106
MUCCIGROSSO A T
12-10568
MUKHERJEE P N
12-10949
MUKHLENOV I P
12-10709
MULLER H J
12-10304
MUNSON R J
12-10318
MURIN A N
12-10449 12-10919
MURPHY GEORGE M
12-10476
MURPHY W T
12-10317
MURRAY J R
12-10605
MURTHY N SREEDHARA
12-11164
MURZINA E
12-10711
MUTO SATORU
12-10409
MUTO TOSHINOSUKE
12-10957
MYLONAS C
12-11150

N

NAITO KUNIO
12-11181
NALIMOV V V
12-10416
NARIN FRANCIS
12-10967
NASKIDASHVILI I A
12-10633
NAUMOV G B
12-10517
NAUTA HENDRIK
12-11143
NEAL R B
12-11089
NEARY G J
12-10318
NELSON D H
12-10450
NEMENOV L M
12-11101
NEMIROVSKII P E
12-10933
NESHPOR V S
12-10465
NESMEYANOV AN N
12-10560
NEWKIRK H W JR
12-10572

HEYMAN M B
12-10283 12-10761
NICHOLSON R B
12-10532 12-10533
NICKOLSKII S
12-10711
NIEDRACH LEONARD W
12-10482
NIKITINA A N
12-10821
NIKITINA N V
12-10928
NIKOLAEVA-FEDOROVICH N V
12-10490
NIKOLAYEV N A
12-10291
NIPPES E F
12-10658
NISHIMURA KEIICHI
12-10878
NIXON A C
12-10455
NOAKS J W
12-10978
NODIOT H
12-10329
NOMOFILOV A A
12-10879
NOMOTO MORIKAZU
12-10914
NOSANOW L H
12-10741
NOSOV V G
12-10920
NOVIK K M
12-10960
NOVIKOV I I
12-11016
NOVITSKIY PETR V
12-10777
NOVOSELOVA A V
12-10427 12-10428
NOVOZHILOV V V
12-10614
NYSATER HANS
12-11072 12-11082

O

OCHKUR A P
12-11123
OHNAE TSUTOMU
12-10697
OLSON R G
12-11032
ORLOV V V
12-10898
ORTHS KURT
12-10795
OSHEROVICH A L
12-10775
OSIPOVA V F
12-10481
OSTER I I
12-10919
OTROSHCHENKO V A
12-10861
OVCHINNIKOV YE P
12-10842 12-10859
OWEN GEORGE E
12-11047
OZHIGOV E P
12-10414

P

PAK V S
12-10530
PALMER RAY F
12-10354
PALUMBO RALPH F
12-10397
PANASYUK V S
12-11102 12-11104
PANDYA SUDHIR P
12-10959
PANOV A A
12-10899
PAPOYAN S A
12-10300
PAPP C A
12-10589
PARKS P B
12-11009
PARR W H
12-10320
PARSONS J A
12-10317
PASCUAL J
12-10477
PASMA PIETER JELTE
12-11051
PASQUA P F
12-10556
PASYUK A S
12-11049
PATRIARCA P
12-10659
PATTEE H E
12-10628
PAYNE H R
12-10555
PEARSON R L
12-11004
PELEKHOV V I
12-11045
PENKIN N P
12-11195
PENNEMAN R A
12-10422
PEPINSKY RAY
12-10756
PERESE D M
12-10317
PEREYASLOVA N K
12-10838
PERFILOV N A
12-10923
PERONA G
12-10781
PERRY JOHN F JR
12-10352
PERSON W B
12-10431
PETRASKU M G
12-10870
PETRUNKIN A M
12-10851
PETRZHAK K A
12-10836 12-10926
PETUKHOV V A
12-10847 12-11105
12-11111
PHILLIPS A R
12-10689
PHILLIPS L E
12-10579
PICKERING JOHN E
12-10296
PIDGEON L M
12-10372
PIERCE C W
12-10980
PIERCY G R
12-11186
PINES W B YA
12-10667 12-10668
PITTET L
12-10341
PLOETZ G L
12-10568
PLYUCHCHEV V YE
12-10384
PODGORETSKII M I
12-11184
POLEVOY R M
12-10945
POLEZZO S
12-11019
POLIVANOV M K
12-10880
POLLARD ERNEST
12-10314
PONOMAREV A I
12-10419
PONTEKORVO B M
12-10693
POPOV M M
12-10948
POPOV V I
12-10946
POWDERLY J E
12-10722
POZDNYAKOV A A
12-11157
PRECKSHOT GEORGE W
12-10546
PREOBRAZHENSKII B K
12-11155
PRESCOTT J R
12-10815
PRESKITT CHARLES A JR
12-11117
PRESTON O
12-10621
PRIMAK WILLIAM
12-10765
PROBST H B
12-10721
PROKHODA I G
12-10739
PROSVIRIN V I
12-10670
PUGACHEV V S
12-10799
PUGH A C P
12-10382

Q

QUIGLEY D
12-10767

R

RABIDEAU SHERMAN W
12-10503
RABINOVICH M S
12-11105 12-11107
RADIONOVA L M
12-10820
RADKEVICH I A
12-10899
RADVANYI P
12-10939
RAIT J R
12-10647
RAKOBOLSKAYA I
12-10711
RAMSAY JOHN B
12-10393
RASETTI L
12-10310
RASORENOV L A
12-10876
RAZUMOVSKIY A N
12-11163
REDMAN M J
12-10491 12-10492
REED D V
12-10400 12-10401
12-10402 12-10403
REES JOHN
12-11067 12-11078
12-11088
REICHERT STANLEY O
12-11038
REID W H
12-10538
RESH V K
12-10816
RETHMEIER J
12-10903
REYKHRUDEL E M
12-10735
RHOTEN MERLE
12-10557
RICCI R A
12-10835 12-10955
RICHARDS C E C
12-10423
RICHARDSON A E
12-10374
RICHARDSON A S
12-10993
RICHES J W
12-11197
RICHMAN D M
12-10980
RICKER C W
12-11042
RIEPPEL P J
12-10628
RIGHTMIRE ROBERT A
12-10941
RILEY J J
12-10661
RITTENHOUSE J B
12-10589
RITZ VICTOR H
12-11126
ROACH D B
12-10639
ROAKE W E
12-10566
ROBELOTTO S M
12-10658
ROBINSON CYRIL H
12-10528
ROBINSON KENNETH W
12-11055 12-11056
12-11057 12-11058
12-11061 12-11062
12-11068 12-11071
12-11080 12-11084
12-11085
ROBINSON ROBERT J
12-10723
ROBSON B A
12-10796
RODIONOV YU F
12-10945
ROGERS GERALD B
12-10433
ROMANOVA YE V
12-10418
ROOT HARLAN D
12-10352
ROSENTHAL M W
12-10982
ROSS A M
12-10679
ROTHMAN S J
12-10632 12-10633
ROWEN JEROME T
12-10433
ROWLINSON J S
12-10507
ROZENTAL I L
12-11050
ROZENTSVEIG L N
12-11139
ROZMAN I M
12-10823
RUBIN N B
12-11114
RUBINO G F
12-10310
RURTSOV V I
12-10714
RUDENKO N S
12-10779
RUDNYY N M
12-10776
RUNNALLS O J C
12-10498
RUPPEN E W
12-11013
RUSHING D E
12-10526
RUSSELL JAMES B
12-10619
RUSSELL R B
12-10613
RUTLEDGE A R
12-10804
RYABCHIKOV D I
12-10481
RYABININ YU N
12-11161
RYBAKOV B V
12-11046
RYBALKA N D
12-10305
RZEWUSKI J
12-11177

S

SABSOVICH L L
12-11103
SAFINA I N
12-10900
SAFONOVA O S
12-10644
SAFRONOV B G
12-10783 12-10790
SAITO NOBUFUSA
12-10485
SAITOV I S
12-11119
SAKURAI KENJIRO
12-10762
SAMOYLOVICH D M
12-10848
SAMSONOV G V
12-10465 12-10654
SANDARS P G H
12-10952
SANDER H H
12-10818
SANDERS J F
12-10936
SARAEVA V V
12-10459
SARKAR S
12-10913
SARMA N
12-10701
SAUER J A
12-10460
SAVAGE W F
12-10658
SAVASTIO LEONARD A
12-11000
SAVIN F D
12-10713
SAWAMURA MAKOTA
12-11134
SAYEG J A
12-10339
SCARONI A
12-10497
SCHELL D H
12-10569
SCHENKEL F W
12-10686
SCHERER J R
12-10431
SCHIFFER J P
12-10893
SCHLEIN H
12-10806
SCHMIDT ROBERT W
12-10336
SCHNEIDER H J
12-10976
SCHOENHERR ROMAN
12-10473
SCHULER ROBERT H
12-10461
SCHULTE JOHN W
12-10474
SCHWAGER J E
12-11005
SCHWARZSCHILD A
12-11044
SCHWIMMER SIGMUND
12-10302
SCOTT J L
12-10984
SEABAUGH PYRTLE X
12-10496
SEARS G W
12-10429
SEBE TAKASHI
12-10957
SEDELNIKOV T KH
12-10898
SEITH W
12-10607
SEKINE TATSUYA
12-10485
SEMENENKO V D
12-10530
SEMENOV N N
12-10410
SEMENOV S S
12-10842
SENIN M D
12-10948
SERGIYENKO V A
12-11167
SETTER LLOYD R
12-10334
SHAFRANOV V D
12-10738 12-10740
SHAHINIAN P
12-10618
SHALAMOV YA YA
12-10883
SHALNIKOV A I
12-10861
SHALNOV A V
12-11098
SHAMOV V P
12-10925
SHAMOVSKII L M
12-10820
SHAPIRO I
12-10493 12-10494
SHAPIRO I S
12-10881
SHAPLEY L S
12-10793
SHAPPERT L B
12-10438
SHAROV B V
12-11188
SHARSHANOV A A
12-11112
SHCHEGOLEVA T A
12-10821
SHCHEPKIN G YA
12-10780
SHCHERBAKOV N A
12-10713
SHCHERBAKOVA YE YA
12-10890
SHERANOV V A
12-10883
SHESKOLSKAYA A YA
12-10413
SHIELD R T
12-10676
SHIMMIN P L
12-10511
SHIRKOV DMITRIY
VASILYEVICK
12-11185
SHIROKOV M I
12-11176
SHISHKIN G V
12-10945
SHISHMAREV O A
12-10642
SHLYAPNIKOV R S
12-10812
SHMUSHKEVICH I M
12-11139
SHOR ARTHUR
12-10336

SHTARKOV L N
12-10932
SHU-FEN VAN
12-10911
SHULGA YU N
12-10656
SHUR L I
12-10840
SIBERT M E
12-11035
SIDOROV V A
12-11046
SIDOROV V M
12-10870
SILVER ROBERT
12-10942
SIMANOV YU P
12-10427 12-10428
SIMMONS E L
12-10333
SIMMONS J
12-10615
SIMONS EUGENE M
12-10593
SIMONS LENNART
12-11020
SINELNIKOV K D
12-10783
SINKEY ROSS J
12-10758 12-10759
SITENKO A G
12-10739
SKIRDA N V
12-10716 12-10841
SKOLD R V
12-10590
SLATIS HILDING
12-10832
SLAUGHTER G M
12-10659
SLEMBER R J
12-11010
SLOMAN M L
12-11007
SLOVOKHOTOV L I
12-10932
SMIRNITSKAYA G V
12-10735
SMIRNITSKII V A
12-10884
SMITH L A
12-10391
SMITH R V
12-10901
SMORODIN IU A
12-10714
SMUSHKOV I V
12-10667 12-10668
SMUTZ MORTON
12-10473
SNELL PHILIP A
12-10686
SNYDER A WILLIAM
12-10553
SOKOL G A
12-10932
SOKOLOV A A
12-10934 12-11142
SOKOLOV M M
12-11123
SOKOLOV YU L
12-10813
SOKOLOVSKIY V V
12-10899
SOLOVEV L D
12-10887
SOLOVEV M V
12-10714
SOLOVEV V G
12-10872 12-10885
SOLOVYEV A N
12-10637
SONESSON ARTUR
12-10464
SOROKIN P V
12-10963
SOUTH DOROTHY J
12-10397
SPARROW E M
12-10539
SPEDDING F H
12-10995
SPINNEY K T
12-11162
SPITZYN VIKT I
12-10408
STANDRING J
12-10607
STANG JOHN H
12-10593
STARITZKY E
12-10422
STEARNS BRENTON
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STEFFEN K G
12-11073 12-11075
12-11077 12-11079
12-11086 12-11087
STEINBERG M A
12-11035
STEINER FRANK C
12-11036
STEPANOV B M
12-11124
STEPHENSON J W
12-10968
STERRY FRANK
12-10528
STEVENS H E
12-10998
STEWART D C
12-10502
STEWART F Y
12-10537
STEWART J C C
12-10972
STOHR J A
12-10563
STOLOV A M
12-11106
STONE F G A
12-10377
STONER RICHARD D
12-10315 12-10316
STORCHHEIN SAMUEL
12-11031
STORHOK VICTOR W
12-10604
STOVER B J
12-10344
STREHLOW R A
12-10499
STRELKOV P G
12-10760
STRETCH K L
12-11023
SU-IUN TSIN
12-10305
SUCHER JOSEPH
12-10868
SUGITA TOSHIO
12-10442
SUMAROKOVA N V
12-10636
SURKOV IU A
12-10962
SUTIN N
12-10376
SUVOROV L
12-10441
SVERDLOV Z M
12-11194
SVESHNIKOV B IA
12-10705
SVIRIDOV V A
12-10861
SWIFT M N
12-10327

T

TAKABAYASI TAKEHIKO
12-11180
TAKETA S T
12-10327
TAKIBAYEV ZH S
12-10839
TALMAGE ROY V
12-10348 12-10349
TALROZE V L
12-10787
TALYZIN A M
12-10849
TAMARU TAKESHI
12-10762
TANNER LEE E
12-10601
TANTSYREV G D
12-10787
TAPLIN GEORGE V
12-10351
TARANOV A IA
12-10963
TARASOV YU A
12-11183
TARMY B L
12-10452
TARNAVSKAYA M V
12-10732
TAUB J M
12-10569 12-10624
12-10625
TAUBMAN A B
12-10451
TAWDE N R
12-11164
TAYLOR C FRED
12-10353
TAYLOR THEODORE C
12-10646
TAYSUM D H
12-10344
TENNERY VICTOR J
12-10573
TENNY ALFRED
12-10336
TERASHIMA YOSHINOSUKE
12-10710
TESO G A
12-10310
THACKERAY D P C
12-10734
THEODORE MARY LOUISE
12-10404
THOMAS F DONNALL
12-10330
THOMAS K
12-11132
THOMPSON A S
12-10966
THOMPSON ROY C
12-10354
THORPE R E
12-10455
TIMM UWE
12-11154
TIMOFEEVA T V
12-10822
TIMOSHENKO N E
12-10369
TINGLEY I I
12-10587
TOBELKO K I
12-10517
TOBIAS CORNELIUS A
12-10326
TOLCHAKEV B V
12-10714
TOLHOEK H A
12-10953 12-10954
TOLPADI S SHIVANANDA
12-10726
TOLSTOV K D
12-10861
TOMBOULIAN D H
12-11099
TOMILIN P I
12-10664
TOROPOV B V
12-11192
TRETON E F
12-10398
TRETYAKOV YE F
12-10850
TRETYAKOVA M I
12-10859 12-10854
TRILLING C A
12-11001
TROITSKIY YU V
12-10863
TRUB I A
12-11018
TRUBNIKOV B A
12-10731
TRUELL R
12-11150
TRULEV YU I
12-11168
TSERKOVNIKOV YU A
12-10733
TSIVOGLOU E C
12-10526
TUCK D G
12-10501
TUKISH E
12-10711
TULINOVA Z I
12-10714
TUNNICLIFFE P R
12-10944
TURCHIN V F
12-11122
TURICHIN AFROIN M
12-10777
TURNER D T
12-10456
TURNER F M
12-10293
TUROVTSEVA Z M
12-10410
TYAGUNOV G A
12-11098
TYUTYUNIK A G
12-10665

U

UJHELYI CSABA
12-10521
UNDERKOFFLER V S
12-11032
UNGER WILLIAM E
12-10446
URETSKY JACK L
12-10728
URSO IRENE M
12-10330
USPENSKAYA T A
12-10514
UTEVSKII L M
12-10643

V

VAISBERG S E
12-10383
VAISENBERG A O
12-10884
VALDNER O A
12-11098
VALTER A K
12-10963
VAN DEN BERG J
12-10903
VAN DILLA M A
12-10344
VAN METRE R A
12-10320
VAN NOOIJEN B
12-10956
VAN TUYL H H
12-10386
VAN WAGENINGEN RIEK
12-11144
VAN WINKLE R
12-10981
VARSHAVSKII YA M
12-10383
VASILIEV I M
12-10305
VASILYEV YU A
12-11192
VAUGHN JAMES C
12-10336
VEDERNIKOVA T I
12-10414
VEKLENKO B A
12-11140
VEKSLER V I
12-11105 12-11110
VENTERS LYDIA
12-10406 12-10407
12-10760
VERESHCHAGIN L F
12-11161
VIGDOROVICH V N
12-10640
VIGIER JEAN-PIERRE
12-11180
VIKLUND H I
12-10513
VINOGRADOV S I
12-11166
VINTAIKIN E Z
12-10641
VLADIMIRSKIY V V
12-10899
VLASOV N A
12-11046
VLASSYUK P A
12-10306
VOGEL K H
12-10554
VOGT G
12-10345
VOIGT A F
12-10374
VOILAND E E
12-10472
VOLKOV V V
12-11049
VORECK W E
12-10768
VOROBEV A A
12-11096
VORTMAN L J
12-10325
VOYKOVSKIY B A
12-10853 12-10854

W

WACHSMANN F
12-10826
WACHSPRESS E L
12-10792
WACHTER M
12-11076 12-11081
WAHRHAFTIG A L
12-10425
WALDRON R D
12-10361
WALKINSHAW W
12-11100
WALUGA T
12-10940
WANGENSTEEN OWEN H
12-10352
WARREN V L
12-10391
WATANABE YOITI
12-11135
WATERMAN M J
12-10469
WATERS E O
12-10531
WATSON W W
12-10782
WAY K
12-10965
WEIGLE WILLIAM O
12-10312
WEINBERGER W R
12-10671
WEINREICH M E
12-10692
WEINREICH M I
12-10385
WEISE E K
12-10677
WEISS HERBERT
12-10406 12-10407
WELLS M B
12-10895
WELSH W E JR
12-10550
WENDROFF BURTON
12-11173
WENTZEL W W
12-10594
WEPFER G
12-10810
WESSEL E T
12-10602
WESTON WILLIAM J
12-10302
WHELAN J S
12-10551
WHITE R W
12-10650
WHITMORE GORDON
12-10314
WIEDERKEHR V R
12-10399
WIESEN J M
12-10794
WIESINGER F W
12-10609
WILDER DAVE
12-10567
WILKINSON W V
12-10286
WILLIAMS DANIEL B
12-10296
WILLIAMS DEAN N
12-10627
WILLIAMS H J
12-10534
WILLIAMS W L
12-10551
WILLIS J
12-10766
WILSON CHARLES O JR
12-10493 12-10494
WINGATE C
12-10743
WOLFF A K
12-11148
WOLFF MILO M
12-11116
WOLTJER L
12-10798
WOODGATE G K
12-10952
WOODWARD A E
12-10460
WOOTON J
12-10534
WORK C P
12-10536
WRIGHT D A
12-10695
WRIGHT J M
12-10405
WU C S
12-11044

Y

YAGOLA G K
12-10776

YAKOVLEV V A
12-10732 12-10836
YAKUNIN M I
12-10836
YAMADA M
12-10965
YAMAJI IWAO
12-10696
YANAGAWA SADAAKI
12-10958
YANOVA L P
12-10451
YAREMBASH E I
12-10427
YEATER M L
12-10894
YEGOROV YU S
12-11168
YELISEYEV V B
12-10862
YEMELYANOV V
12-10440
YEREMENKO V N
12-10653
YONEHIRO EARL G
12-10352
YOSHIOKA NAOYA
12-10478
YOUNG EDWARD
12-10518
YOUNG F W JR
12-10724
YU K
12-11017 12-11189
YU S
12-11149

Z

ZACHARIASEN F
12-11170
ZAIDEL A N
12-10411
ZAIKOVSKII F V
12-10480
ZAMYATNIN YU S
12-10900 12-10918
12-11192
ZAOZERSKIY I N
12-10466
ZAPALSKI G
12-10940
ZATSEPIN V
12-10711
ZELDOVICH YA B
12-10888
ZELTMANN ALFRED H
12-10453
ZHDANOV A P
12-10716 12-10840
12-10841
ZHILEYKO G I
12-11094
ZHURALEV A A
12-11106
ZINOV V G
12-10874
ZIV D M
12-10586
ZOLOTAVIN A V
12-10851
ZUDILOVA G V
12-10653
ZVYAGIN S B
12-11101

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